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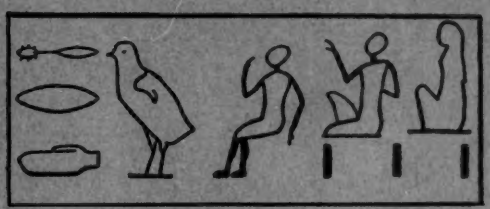
CHILD DEVELOPMENT



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DETERMINING AND NUMERATING ADJECTIVES IN CHILDREN'S SPEECH[1]

JOHN B. CARROLL

The difficulty in scientifically attacking the basic aspects of the linguistic behavior of the child has forced investigators to concern themselves largely with extrinsic determinants and concomitants of speech development, such as intelligence, sex, home environment, and sibling status; and with the more obvious and readily measurable intrinsic characteristics of speech, such as vocabulary growth and sentence length. The analysis of basic grammatical processes must, however, be made before such higher-order phenomena as sentence length can be adequately understood. Although a number of studies have been published on sentence structure, sentence length, and degree of grammatical complexity, the present analysis is one of the first to investigate the development of a specific set of grammatical phenomena - namely, the use of determining and numerating adjectives with substantives. It attempts 1) to ascertain whether there are significant trends in the frequency of such words, and in which directions these trends lie; and 2) to describe grammatical development in terms of these trends.

The rules for the use of determiners and numeratives are stated by Bloomfield (1, pp. 202-6). The following outline will help to clarify these rules as well as Bloomfield's classification of adjectives:

BLOOMFIELD'S CLASSIFICATION OF ADJECTIVES

ADJECTIVE EXPRESSION: Class meaning: "character of specimens of a species of objects."

- A. Descriptive adjectives: Class meaning: "qualitative character of specimens;" e.g., blue, soft, tall.
- B. Limiting adjectives: Class meaning: something like "variable character of specimens."
  - 1. Determiners: Class meaning: "identificational character of specimens." (The class is defined by the fact that certain types of nouns are always accompanied by determiners).
    - a. Definite: Class meaning: "identified specimens." Consists of: Possessive adjectives; this, these, that, those, the.
    - b. Indefinite: Class meaning: "unidentified specimens." Consists of: a (an), any, each, either, every, neither, no, one, some, what, whatever, which, whichever, many a, such a, what a.
  - 2. Numeratives: Class meaning: "quantified specimens." Consists of: all, both, few, same, very, one, much, more, less, and others.

NOUNS AND THEIR DETERMINERS

I. NAMES (PROPER NOUNS): These take no determiner, are always in the definite category (in the sense defined above), and do not have a plural.

II. COMMON NOUNS: Class meaning: "species of object occurring in more than one specimen."

A. Bounded Nouns. Class meaning: "species of object occurring in more than one specimen, such that the specimens cannot be subdivided or merged."

	Singular	Plural
Definite:	(determiner)...	determiner required
Indefinite:	(not required)...	" not "

[1] *From the Institute of Child Welfare, University of Minnesota.*

B. Unbounded Nouns. Class meaning: "species of object occurring in more than one specimen, such that the specimens can be subdivided or merged;" e.g., paper, heat, ice, water, sand, etc.

1. Mass nouns. Always definite; no plural. Class meaning: as in B with the proviso that the specimens "exist independently."
2. Abstract nouns. Class meaning: as in B but the specimens "exist only as the demeanor (quality, action, relation) of other objects."

	Singular and Plural	
Indefinite:	no determiner:	"all specimens."
Definite) Indefinite)	determiner:	"separate specimens."

Note: Some words which belong properly to one category sometimes may fall in another category, by a phenomenon known as "class cleavage". E.g., we say, "milk is healthful," but also, "the milks obtainable in the city;" in the second case the (ordinarily unbounded) noun milk has become a bounded noun.

This investigation notes all occurrences, in a sampling of children's speech, of determining and numerating adjectives, as well as words of these categories which by class cleavage are used as pronouns. The study of these words provides one of the easiest approaches to minute details of syntax because they occur frequently and constitute a relatively large part of the total number of words,

PROCEDURE

The protocols studied each contained 50 responses of children 2.5, 3.5, and 4.5 years old (the ages were accurate within a month), enrolled in the nursery school and experimental kindergarten of the University of Minnesota Institute of Child Welfare. The "free" and "controlled" situations and the method of recording the responses are described by Goodenough (4), and need not be explained here. The number of children, their mean I.Q., and the mean number of words per child are indicated in Table 1, together with the rank order correlation between the number of words in the "free" and the "controlled" situations.

In this study, the free and controlled situations were in general not distinguished, since the data from both situations were pooled on the assumption that in this way differences between the situations would be largely eliminated. Thus, a block of 100 responses per subject was obtained - i.e., 50 responses from each situation. Rank order correlation coefficients between total words in F and C situations range from +.04 to +.65. Section G in Results presents data on the factor of situation.

Mimeographed record sheets were prepared for tabulating the data, and the frequencies of the occurrence of each determiner and numerative were obtained, together with the type of noun with which each was associated. Tabulation was also made of the occurrence of determiners and numeratives which by class cleavage are also used as pronouns. In counting the words, the following rules were developed:

1. Proper nouns used as possessives were counted as possessive adjectives, e.g., in Bill's hands; or as possessive pronouns, e.g., in Are they Bill's? The syntactical constructions involved justify this procedure.
2. Possessive pronouns corresponding to possessive adjectives were counted among the pronouns even when the form is different. E.g., his (adj.) is the same as his (pron.), but my (adj.) is different from mine (pron.).

3. Words combined with -thing and with -one or -body were counted among the adjectives, since their construction is similar to the construction of true adjectives -one was counted among the indefinite pronouns.

4. Determiners used in isolation were not counted. E.g., What's the... was found among the responses.

5. All was not counted when used as an adverb, as in "all done."

RESULTS

A. Total words (Table 1). The mean number of words spoken by each child rose with negative acceleration from 2.5 to 4.5 years of age. There were significant differences from each age to the next, but no significant sex differences, according to Fisher's t-test.[2] Nevertheless, the girls maintained a lead in mean words per child at 3.5 and 4.5 years. Since the "controlled situation" in this study is the same as the situation used by McCarthy (7) and Day (3), the mean length of response (obtained by dividing the mean number of words per subject by 50) in the controlled situation is comparable to the corresponding measure used by these authors. The mean lengths of response in the controlled situation for children of ages 2.5, 3.5, and 4.5 years are respectively 2.35, 3.59, and 4.33 words. Judged by this measure, the children studied here stand between McCarthy's singletons and Day's twins in linguistic maturity.

B. Total words Tabulated (Table 2; Fig. 1a). The "number of total words tabulated" is to be understood as including (1) determiners, (2) numeratives, and (3) corresponding pronouns by class cleavage. Significant age trends in the mean total words tabulated were found from each age to the next, but no sex differences were significant. Again, the girls were slightly ahead at 3.5 and 4.5, although apparently behind at 2.5 years. The proportion of the total linguistic sample comprised by the words counted in this study seemed to remain constant at about 15 per cent. A proportion of this kind increasing with age would tend to show increasing complexity of grammatical structure, but the expectations were not fulfilled by these data. The increase in total words tabulated from 2.5 to

TABLE 1

MEAN NUMBER OF WORDS IN THE PROTOCOLS, IN BOTH THE FREE AND THE CONTROLLED SITUATIONS

Age	Sex	N	Mean I.Q.* (Verbal)	Mean Words per Child				Rho between F and C
				F	C	Total	S.D.**	
2.5	M	8	113.0	95.0	123.1	218.1	55.19	+.30
	F	9	115.8	103.9	112.1	216.0	54.89	.65
	All	17	114.3	99.7	117.3	217.0	53.29	.40
3.5	M	15	113.7	149.6	180.5	330.1	72.38	.65
	F	17	116.3	167.1	178.8	345.9	61.36	.08
	All	32	115.1	158.9	179.6	338.5	65.13	.35
4.5	M	14	111.6	182.1	211.4	393.5	72.01	.04
	F	24	114.8	197.6	219.1	416.8	89.87	.27
	All	38	113.5	191.9	216.3	408.2	83.82	.16

*I.Q.'s based on Minnesota Pre-School Scales, Verbal Score.

**All standard deviations are calculated from R. A. Fisher's formula using (N-1) in the denominator.

[2]*The probability level of .05 (i.e., 5 chances out of 100 that t would occur by chance alone) is used as the point distinguishing significant from non-significant differences between means.*

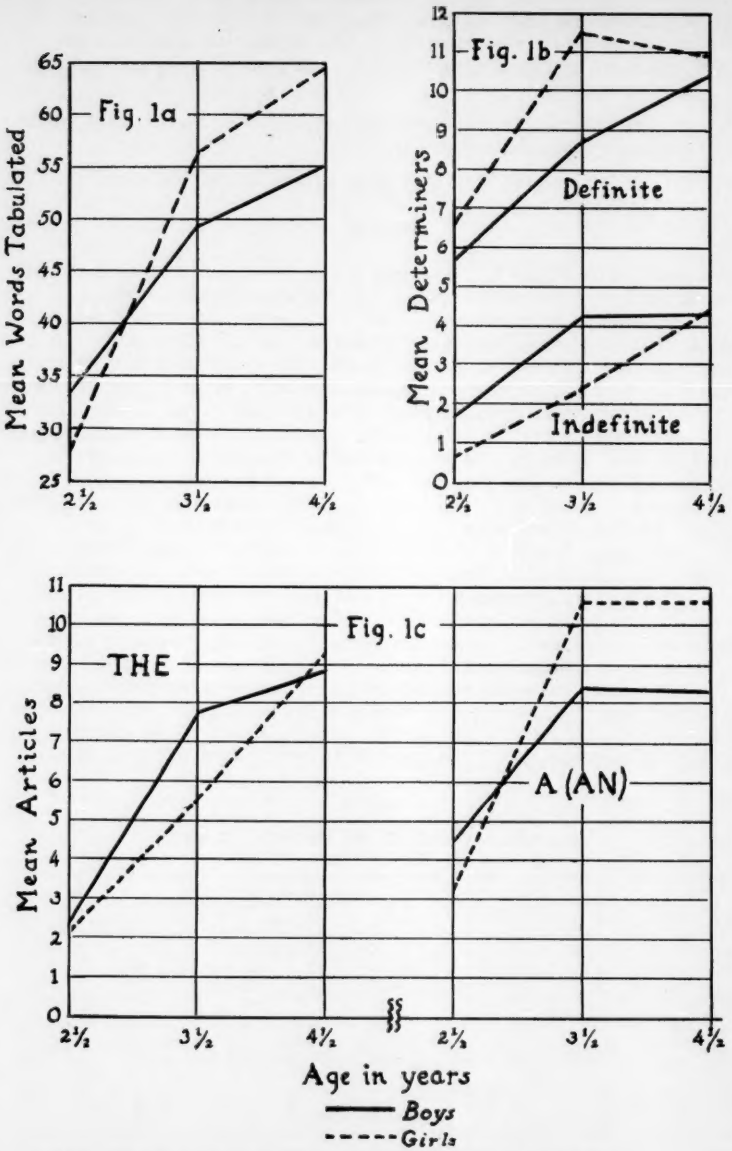

Fig. 1a. Mean number of words tabulated: age trends.

Fig. 1b. Mean number of definite and indefinite determiners (excluding articles): age trends.

Fig. 1c. Mean number of articles THE and A (AN): age trends.

TABLE 2

TOTAL NUMBER OF WORDS TABULATED: NUMERATING AND DETERMINING ADJECTIVES PLUS OCCURRENCES OF THE CORRESPONDING PRONOUNS

		ADJECTIVES AND PRONOUNS				
Age	Sex	Mean determiners	Mean numeratives	Mean wds. tabulated	S.D.	Per cent of all words
2.5	M	33.1	.37	33.50	17.34	15.35
	F	27.2	.33	27.33	14.71	12.75
	All	30.0	.35	30.35	15.81	14.00
3.5	M	46.6	2.53	49.13	11.44	14.88
	F	53.6	2.94	56.54	12.78	16.35
	All	50.4	2.75	53.15	12.46	15.67
4.5	M	53.1	2.35	55.43	17.92	14.09
	F	61.0	3.66	64.71	18.71	15.53
	All	58.1	3.18	61.29	18.73	15.02

TABLE 3

NUMBER OF PLACES FILLED ON THE TABULATING SHEET; RANK ORDER CORRELATIONS BETWEEN MEASURES

		Places filled		Rank order correlations (Rho)		
Age	Sex	Mean	S.D.	Total words and words tabulated	Places filled and total words	Places filled and words tabulated
2.5	M	7.75	2.25	.86	.83	.86
	F	8.00	2.55	.70	.55	.87
	All	7.88	2.34	.77	.70	.89
3.5	M	12.00	3.20	.71	.52	.71
	F	12.80	2.60	.53	.32	.45
	All	12.37	2.88	.67	.52	.63
4.5	M	15.36	3.14	.59	.72	.50
	F	15.71	3.73	.71	.77	.89
	All	15.58	3.49	.65	.71	.76

3.5 years was largely due to an increase in determiners and corresponding pronouns, but also due to the appearance of more numeratives, which were very sporadic at 2.5, but occurred in greater numbers at 3.5 and 4.5 years.

C. Number of places filled on the tabulating sheets (Table 3). This classification refers to what might be termed the "grammatical vocabulary" of the children with respect to the types of words studied here. Since different spaces were provided on the tabulating sheet for noting occurrences of adjectives with mass nouns and with common nouns, a child would be given extra credit by this measure if he used determiners or numeratives with mass nouns as well as with common nouns. The age trends shown in the means were highly significant, since the relative variability of this measure was considerably less than that of other measures used in this study. Table 3 also presents rank order correlations between (1) total words, (2) words tabulated, and (3) places filled. The correlation between (2) and (3) tended to be slightly higher than that between (1) and (3), as would be expected, but most correlations indicate the comparable validity of the measures used. Grammatical development thus takes place pari passu in all aspects measured here.

D. Definite and indefinite adjective (determiners), excluding the articles (Table 4; Fig. 1b). In the means, age differences were only significant from 2.5 to 3.5 years. Consideration of the data from all ages shows that the girls

TABLE 4

DEFINITE AND INDEFINITE ADJECTIVES EXCLUDING THE ARTICLES

Age	Sex	DEFINITE Mean	DEFINITE S.D.	DEFINITE Per cent of total	INDEFINITE Mean	INDEFINITE S.D.	INDEFINITE Per cent of total	TOTAL Mean
2.5	M	5.67	4.03	76.3	1.75	2.43	23.7	7.42
	F	6.55	5.17	91.0	.66	.87	9.0	7.21
	All	6.13	4.55	83.9	1.17	1.81	16.1	7.30
3.5	M	8.80	5.77	67.7	4.20	3.03	32.3	13.00
	F	11.48	5.51	83.0	2.35	1.62	17.0	13.83
	All	10.20	5.70	76.0	3.22	2.52	24.0	13.42
4.5	M	10.43	6.11	70.9	4.28	1.98	29.1	14.71
	F	10.96	5.95	71.5	4.37	2.77	28.5	15.33
	All	10.76	5.93	71.3	3.34	2.48	28.7	15.10

were ahead with respect to definite adjectives, and behind with respect to indefinite adjectives, in spite of the convergence of the curves at 4.5 years. Proportions of definite and indefinite adjectives showed an age trend in the direction of relatively fewer definite adjectives and more indefinite adjectives; in this respect the girls were behind, because of their more frequent use of definite adjectives. But regardless of proportions, it is also true that at all ages the girls used more definite determiners, especially possessive adjectives.

It may be suggested here as a possible interpretation of these data that although girls are ahead of the boys in the use of easier elements of language, once they have been learned, the boys tend to be ahead, at least in the earlier years, in the use of the more complex elements of language - i.e., although they have learned the easier elements they do not use them so much to the exclusion of the more difficult elements as do the girls.

E. Use of "the" and "a (an)" (Table 5, Figs. 1c and 2b). All age trends were significant except from 3.5 to 4.5 years in the case of "a"; there were no significant sex differences, though girls tended to be ahead of the age trend in the case of "a" and behind in the case of "the". The fact that the growth curve for "a" levels off while the curve for "the" continues its rapid acceleration is reflected in the steady trends shown by the relative proportions of "the" and "a", where "the" constitutes 36.9 per cent of all articles at 2.5 years and 48.3 per cent at 4.5 years. A high proportion of "a" is probably an immature characteristic, since word-counts of adult English speech find "the" more frequent than "a". M. E. Smith (9) finds "a" more frequent than "the" in children's speech; in her frequency list "a" holds rank 7, "the" holds rank 10. It would appear, then, that the age trends found in this study are correct.

Although it was found (Section D) that definite adjectives are more common, here the indefinite "a" is more frequent than the definite "the". This fact indicates that we must be cautious in reasoning strictly in terms of categories when analyzing the processes operating in grammatical development. On the other hand, the interpretation of the data presented here is partly dependent upon the possibly large errors in recording "the", since the sound (t) is relatively difficult for children to articulate, and for recorders to distinguish.

F. All determiners (Table 6). Table 6 combines the figures of Tables 4 and 5, with the result that the approximately opposite trends of the latter tables are canceled out. Sex differences are largely eliminated, and age trends are only significant from 2.5 to 3.5 years. The proportion of definite to indefinite determiners remains approximately constant from 2.5 to 4.5 years. The constancy of this proportion may indicate that there is a tendency, inherent in

TABLE 5

THE ARTICLES, THE AND A (AN)

Age	Sex	THE Mean	THE S.D.	THE Per cent of total	A (AN) Mean	A (AN) S.D.	A (AN) Per cent of total	TOTAL Mean
2.5	M	2.37	4.37	34.6	4.50	6.09	65.4	6.87
	F	2.11	3.92	39.6	3.22	4.60	60.4	5.33
	All	2.24	4.01	36.9	3.82	5.22	63.1	6.06
3.5	M	7.73	5.69	47.0	8.40	6.49	52.1	16.13
	F	5.53	4.72	34.3	10.60	5.74	65.7	16.13
	All	6.56	5.23	40.7	9.56	6.10	59.3	16.13
4.5	M	8.86	6.05	51.5	8.36	4.67	48.5	17.22
	F	9.29	7.66	46.7	10.60	5.57	53.3	19.89
	All	9.13	7.03	48.3	9.76	5.32	51.7	18.89

TABLE 6

ALL DETERMINERS (ADJECTIVES ONLY)
(Tables 4 and 5 Combined)

Age	Sex	Mean	S.D.	Per cent total Determ.	Mean	S.D.	Per cent total Determ.	Mean	S.D.	Per cent of Total Words
2.5	M	8.00	5.29	56.1	6.25	7.92	43.9	14.25	11.59	6.53
	F	8.67	6.58	69.0	3.89	4.75	31.0	12.56	10.29	5.81
	All	8.35	5.83	62.6	5.00	6.34	37.4	13.36	10.61	6.18
3.5	M	16.53	10.08	56.7	12.60	5.88	43.3	29.13	12.71	8.83
	F	17.00	8.34	56.8	12.95	5.42	43.2	29.94	10.08	8.66
	All	16.78	9.05	56.7	12.78	5.54	43.3	29.56	10.84	8.73
4.5	M	19.28	8.99	60.4	12.94	4.85	39.6	31.93	10.52	8.12
	F	20.25	10.43	57.5	14.96	7.16	42.5	35.21	14.96	8.44
	All	19.89	9.82	58.5	14.10	6.44	41.5	34.00	13.43	8.32

either the language or the individual, or both, to maintain equilibrium between the definite and indefinite categories and within the category of determiners, regardless of the relative frequencies of various sub-categories. The last column of Table 6 shows an age trend in the percentage of the total words comprised by determiners. After 3.5 years the percentage remains constant at about 8.5 per cent, though there are possibly further trends at greater ages.

G. Adjective vs. pronoun usage of determiners with class cleavage (Table 7; Fig. 2a). All determiners except "the" and "a" may be used as pronouns by class cleavage, except that some of the possessive adjectives are changed in form in pronoun use. Pronouns do not involve the use of an accompanying noun and therefore may be assumed to represent a simpler linguistic phenomenon than adjectives. The child learns to say "What's this?" and "What's that?" before he learns to use the constituent words in other contexts. Therefore, the increasing use of adjective determiners relative to the use of the same words as pronouns should be an index to linguistic maturity. A "pronoun-adjective index" is found by dividing the number of pronouns by the number of adjectives, either in a particular sample or in the total group.

Age trends were not found to be as definite as expected, but the indices were in general lower for ages 3.5 and 4.5. Most clear-cut was the trend in the case of the indefinite determiners, where the pronoun-adjective index dropped from 5.30 at 2.5 to 2.05 at 4.5 years. Relatively to the age trend, the girls were significantly behind the boys in this case. This sex difference can be

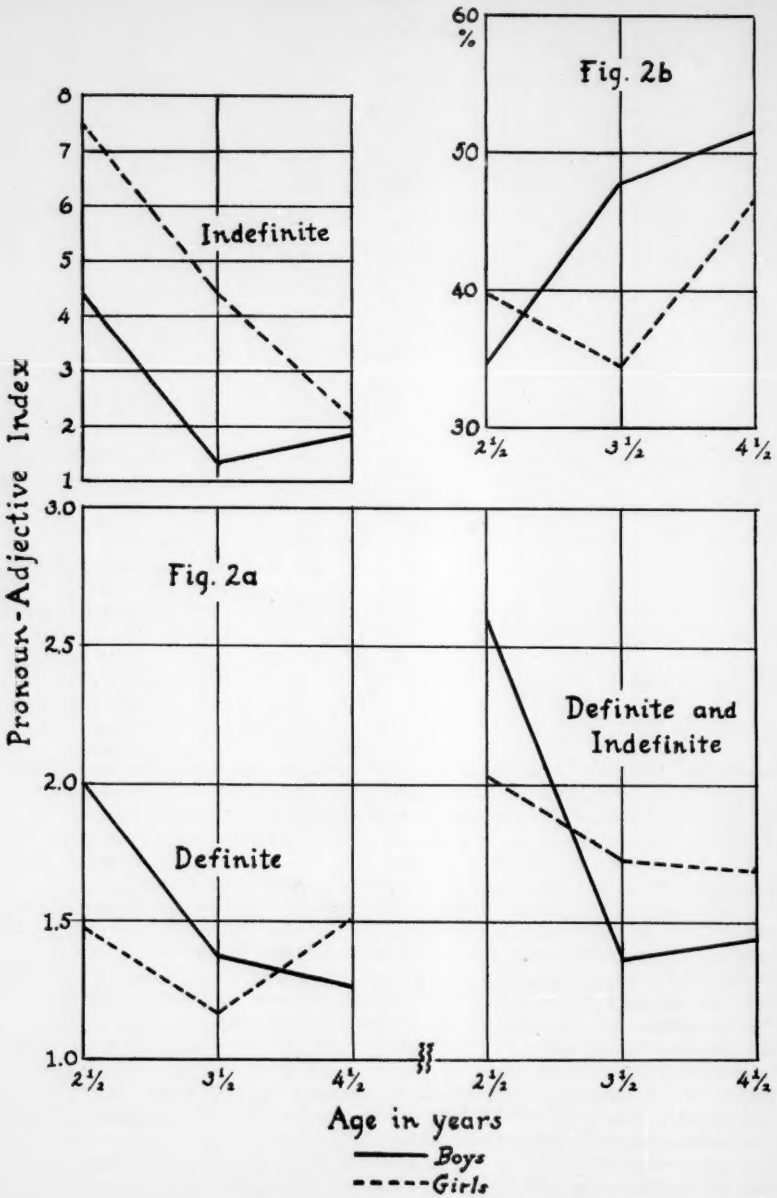

Fig. 2a. Pronoun-adjective index: age trends.

Fig. 2b. Percent THE of THE and A (AN): age trends.

TABLE 7

ADJECTIVE PRONOUN INDICES FOR DETERMINERS WITH CLASS CLEAVAGE

Age	2.5			3.5			4.5		
Sex	M	F	All	M	F	All	M	F	All
Definite	2.00	1.47	1.70	1.37	1.16	1.25	1.26	1.50	1.41
Indefinite	4.36	7.50	5.30	1.33	4.40	2.52	1.88	2.15	2.05
All	2.68	2.03	2.28	1.36	1.72	1.55	1.44	1.68	1.60

TABLE 8

THE ARTICLES, THE AND A(AN), IN THE "FREE SITUATION" ALONE, WITH PROPORTIONS OF THE ARTICLES IN BOTH THE "FREE" AND THE "CONTROLLED" SITUATIONS *

		THE		A (AN)		
Age	Sex	Mean	Per cent of All the's	Mean	Per cent of All a's	Per cent "Free" of All Words
2.5	All	.41	18.4	.47	12.3	45.9
3.5	All	2.96	45.3	2.03	21.2	46.9
4.5	M	3.14	35.5	3.50	41.8	46.2
	F	3.54	38.1	3.33	31.5	47.4
	All	3.39	37.2	3.39	34.8	46.9

*The last column gives for the purpose of comparison the percentage of the words in both situations comprised by all words in the free situation.

interpreted according to the hypothesis suggested in section D. Although the girls had progressed farther in their mastery of the (common and easy) definite determiners (adjectives), they still favored the use of the corresponding pronouns in the case of the indefinite determiners,

H. Effect of situation on the frequency of "the" and "a". Table 8 presents the mean frequency of "the" and "a" in the free situation responses, with the percentage of all articles which these articles constitute. At ages 3.5 and 4.5, the percentages for "the" and "a" are approximately alike, though smaller than the proportion of total words which the words in the "free situation" responses constitute. (See Table 1). Thus "the" and "a" are relatively more frequent in the controlled situation, but with respect to the differential frequency of "the" and "a" the free situation resembles closely the controlled situation. However, at 2.5 years the scarcity of articles in the free situation responses suggests that the learning of the more complex grammatical techniques occurs in "controlled" situations, i.e., situations involving older persons and a variety of play objects and other stimuli. The relationships found in the case of "the" and "a" probably hold for other linguistic measures used in this study, but they have not been worked out.

I. Use of descriptive adjective phrases (Table 9). The psychological factors involved in the use of determiners and numeratives may be assumed to be more complicated when a descriptive adjective is interposed between the limiting adjective and the noun. For example, "a big boy" represents a higher degree of linguistic integration than "a boy", which in turn is higher than simply "boy". The use of descriptive adjective phrases (i.e., all combinations of descriptive adjectives and substantives, with or without determiners) was noted, and the quantitative findings are presented in Table 9. Since descriptive adjective phrases must follow the rules concerning the determiners required with substantives, certain combinations are incorrect - namely, where a singular noun is modified by a descriptive adjective without a determiner. For example, "good boy" alone is incorrect. A mass noun, however, can stand without a determiner; e.g., "fresh milk". These details, taken together, account for the lack of

TABLE 9

MEAN NUMBER OF DESCRIPTIVE ADJECTIVE PHRASES

Age	Sex	With Determ.		Without Determ.		Total
		Sing.	Plu.	Sing.	Plu.	Sing. and Plu.
2.5	M	1.25	.00	1.75	.38	3.38
	F	.78	.00	1.00	.22	2.00
	All	1.00	.00	1.35	.29	2.65
3.5	M	3.47	.07	.53	.13	4.20
	F	4.00	.12	.41	.29	4.88
	All	3.75	.09	.50	.22	4.56
4.5	M	3.50	.36	.72	.14	4.71
	F	5.21	.08	1.37	.37	7.04
	All	4.58	.18	1.13	.29	6.18

obvious trend in Table 9 under "Without determiners, Singular". The most outstanding trend is in the case of descriptive adjective phrases involving a singular noun and a determiner. The much faster development of the girls in this respect should be pointed out. Other types of phrases are so infrequent that no generalizations can be made.

INTERPRETATIONS OF GRAMMATICAL DEVELOPMENT

Introduction. The mere observation of children's speech cannot solve all the problems of grammatical development. Some of these problems might possibly be attacked experimentally, especially if they were formulated in terms of hypotheses such as those offered here. Accordingly, tentative interpretations of trends in grammatical development will be set forth in these pages in the hope that they will be suggestive for future experimentation.

In view of the circumstances surrounding the obtaining of the protocols used here, certain assumptions[3] concerning their interpretation are necessary, as follows: 1) that the responses give an adequate picture of the situations in which they occurred; 2) that the intonations and other linguistic phenomena not directly recorded can be read into the responses; 3) that the recorders have accurately recorded what the children actually "meant to say"; 4) that processes occurring at very early stages are reflected in trends revealed in the growth curves from 2.5 to 4.5 years.

Principles of syntactical development. Various behavioristic writers (e.g., Allport, Social Psychology; Weiss, Theoretical Basis of Human Behavior; etc.) have worked out stimulus-response schemas to explain an infant's learning to make a simple linguistic response, such as the word "doll" at the sight of a doll. The period of babbling responses merges into a period of combined selection and imitation (discrimination and reinforcement). It may occur that the child makes a response sounding like "doll" when a doll happens to be in the environment, whereupon the child is rewarded by an older individual with (e.g.) a pat on the back. After a number of such occurrences the response has been conditioned to the actual doll as a substitute stimulus. On other occasions, the child makes a response sounding like "doll" when a doll is not present. Older persons, inferring that the child wishes his doll, bring the doll to him and eventually condition the child to say "doll" when he wishes the doll. In this situation the doll serves as the reward. B. F. Skinner (8) has thought it useful to distinguish between the two situations, calling the word as learned in the former situation a "tact" and the word as learned in the latter situation a "mand".

[3] *It is not claimed, however, that these assumptions necessarily have any basis in fact.*

But the older person will not always say simply "doll", but often "a doll", or "the doll", or "that's the doll". In his unconscious attempts to approximate what he hears, especially after he has learned the meaning of the word "doll", the child will begin to say "a doll" or "the doll" after the older person. This will usually occur in the tact situation (i.e., when the response is made in the presence of the doll but is not necessarily reinforced with the doll but with some other reward), since older people are more likely to reinforce the response in this situation. In the mand situation (i.e., when the doll is not necessarily present but is given as a reward), the mother is usually inclined to infer that the child has already learned "doll", since he seems to be asking for it. Most word-learning in early stages occurs in tact situations until, at least, the naming stage appears.

Thus far the child has learned only simple phrases like "a doll" or "the doll". Guillaume (5, 6) has suggested that these simple, conventionalized, often-used phrases are patterns from which elements of free combination are "differentiated". An element is differentiated in meaning when it is no longer a predicate of a total situation but a counterpart of a specific entity which recurs in various situations; it is differentiated grammatically when it has a functional individuality independent of any phrases in which the element may occur. The concept of differentiation proposes to explain the detaching of the "a" from "a doll", and its use in "a telephone" before the child has ever heard that phrase. It involves the hearing of a great number of phrases like "a doll", "a man", etc., before "a" can be used in a completely new context. This process may be classed as a special type of concept formation, in that such words as "doll", "man", etc., are recognized as forming a class of words which can be connected with "a". Semantic and grammatical differentiation seem to occur simultaneously; i.e., functional differentiation involves a gradual learning of the meaning of the unit which is being differentiated. In the case of "a", the meaning would develop for the child as "one specimen", since "a" is usually associated with the single occurrence of an object. However, several cases of the incorrect use of "a" have been found: "a bunnies" (3.5 Girl); "a new shoes".

By the same token, "doll" becomes differentiated in the sense that a certain number of words are recognized as permissible before it; e.g., in "this doll", "the doll", "any doll". Through the mutual differentiation of each word in any elementary phrase pattern, grammatical pattern as such assumes psychological reality. The process of analogy, as it is often termed by linguistic scientists, can only be understood in terms of mutual differentiation, and not in terms of mere substitution. For example, substitution would lead to the following absurdity:

The man: the water: a man: x

where x would be a water, a linguistic impossibility in English unless class cleavage is considered.

Until "doll" has been heard and learned in another pattern (e.g., "that's the doll"), it cannot be generally used in patterns similar to "that's the doll". Each new conventionalized pattern provides opportunity for new sets of differentiations.

Incorrect differentiation occurs when the process of differentiation as such leads in a direction which does not conform to the structure of the language being learned.

Indication and limiting adjectives. Indication, according to Collinson (2), is "the use of a word or gesture whose function it is to direct attention either towards or away from a given item or items," or "to point to (or away from) some item... or to mark some item already presented...." Most of the limiting adjectives treated in this study are "indicaters", words which serve the function of indication. It is possible to set up a complete and logically coherent system

of indication, but as the English language does not do this the child must learn the various types of indication separately, each in its proper context. Many types of indication can be expressed in single-word sentences. Since indicaters do not specifically refer to the object in question - for example, "that" is not equivalent to "doll", though used in reference to the doll - the child learns a word like "that" as a characteristic of a situation. "That" would normally be accompanied by a pointing gesture on the part of the mother; while imitating the pointing the child would say something like "dat!" Later a phrase like "what's that?" would be learned when the mother is trying to get a naming-response from the child. The child would learn that this phrase would be rewarded with a name; the stimulus-response scheme is in the form of a "mand". The so-called naming stage is really a period during which the child is continually asking to be rewarded with name-words.

Types of phrase-wholes. There are numerous phrases which are probably learned as wholes by the child. Although we cannot determine the origin of a phrase-whole without making observations of the first occurrences of each new word or grammatical pattern, it is allowable to hypothesize the form of certain larger wholes. Where this is done, the hypothetical original phrase is starred, after the practice of the comparative philologists.

1. Nursery rhymes are an important source of learned phrase-words. For example, "Mary had a little lamb"; "Jingle bells...all the way"; "Catch a nigger by the toe"; and many others. The presence of nursery rhymes in the speech samples used here was a complicating factor since many phrase-wholes were included which the children would probably not use in spontaneous conversation. An interesting investigation could be set up on the hypothesis that learning of rote material is an important factor in speech development.

2. Phrases with articles; e.g., a doll; the doll. The learning of the distinction between a and the is discussed below. Support for the theory that article-noun phrases are learned as wholes is lent by the consideration that if the article and the noun were each learned as separate units, the child might juxtapose them and produce (e.g.) a water. Since he seldom commits errors of this type, the article-noun phrases in his speech are probably reproductions or variants of heard phrases.

3. Phrases with articles and descriptive adjectives. The phrase "and a big little one" (3.5 Girl) may be explained on the basis that little had not been differentiated from the phrase-whole little one.

4. That, learned as a single word. Later, what's that? What that? is often found. The same remarks apply to this. - That's the way; that way. Later found in "that's the way you pump." (3.5 Girl). - That one; this one are learned as selective responses, also as the responses to the question Which? - That's a... That's was incorrectly differentiated by a child who said "That's that's that's." (3.5 Girl).

5. What? - also learned as a single word. At this point, what, this, and that can be differentiated out of their respective original phrase wholes. - For what is associated with Why? Incorrect differentiation was shown by a child (3.5 Boy) who said "Why are you writing for?"

6. More; s'more would probably be learned as mands. Some more was still undifferentiated in the response "Don't push me some more" (3.5 Boy). The child had used some more correctly in a previous response. - Any in any more would be differentiated with respect to negatives: "I can't play any more games" (3.5 Boy).

7. Wait a minute; a little while; after a while are certainly phrase-wholes because they are idiomatic constructions which cannot easily be meaningfully analyzed.

8. A whole bunch of ...; a whole lot; a whole bundle of.... These also are idiomatic. One child (3.5 Boy) said "a whole bundle of doggies", possibly from a whole bundle of (e.g.) sticks.

9. Miscellaneous: Somepin'; something; something else (3.5 Boy). - One of those; one of them, etc. - Another one. - Mine; it's mine; that's mine;

yours; it's yours; etc. - every day; everyone. - All through; all the time; all the water (3.5 Boy). - All kinds of...; what kind of...

Many other phrase-wholes involving "indicaters" might be cited, but the list as given probably represents the main types. It would be interesting to study a child's vocabulary in terms of the phrase-wholes contained in it. Phrase-wholes may be of very diverse types. Even such a mistake as the response "What the kitty says?" may be perhaps interpreted as the incorrect differentiation of a long phrase-whole such as "Hear what the kitty says!"

As Guillaume notes, children are often observed to experiment with phrase patterns. Several more or less consecutive responses of a 3.5 year old girl are reproduced here:

Response 31, 32: "I want that piano thing again.
33: I want that other piano thing again.
34: .... the other noise.
40: .... that other thing.
41: .... that other mousie thing."

Interpretation of pronoun-adjective ratio. Table 9, as has been noted before, shows a steady trend in the direction of more frequent adjective use of words like "this", "that", etc. In the case of definite determiners, the trend was not as marked as in the case of indefinite determiners, but inspection of the tabulations shows that if the possessive adjectives were dropped from the definite category, more comparable trends would appear. The more frequent occurrence of pronouns probably indicates that the child learns simple phrase-words like "that!" "this!" before he learns more complex ones like "this one"; "this ball"; etc. Though it may be thought that pronoun use is more frequent because adjective use requires the knowledge of the noun (e.g., in "this telephone"), this may not necessarily be true since the child can always say "this thing" or "this one" if he has not learned the name of the object in question. The true explanation should probably be in terms of the phrase-whole learned first. A factor working in the opposite direction, however, is that as in adult speech the pronoun usage serves as a convenient abbreviation. For example, one child (2.5 Girl) said first, "Open dis", and when her request was not respected, she insisted, "Open dis door".

The Articles. Table 5 shows a much greater frequency of "a" in the earlier years, with a trend toward relatively greater use of "the". A tentative explanation for this phenomenon is that the mother, in teaching her child the names of objects, is more likely to use the indefinite article (e.g., "a ball", "that's a ball"), because she is more interested in the generic term "ball" than in "ball" as the name for this particular ball. When the child learns to ask "What's that?" he will get replies such as "That's a doll", "That's a horse". Only in practical situations is it necessary to use the definite article, where both child and teacher have a particular ball in mind. They may say, "Where's the ball?" "Here's the ball", etc. As the child grows older it is increasingly necessary for him to conceptually manipulate identified specimens, and as a result, more "the's" are found in his speech. While "a" shows little increase from 3.5 to 4.5 years, the curve for "the" continues its rapid (though negative) acceleration.

Mass nouns. The use of determiners with mass nouns is learned according to the phrase-whole principle. The child hears "the snow" but seldom "a snow"; hence he rarely makes the error of saying "a" with "snow" or other mass nouns. The class meaning of mass nouns also prevents his saying "a snow".

SUMMARY AND CONCLUSIONS

1. The mean number of words spoken by each child in 100 responses rises significantly with negative acceleration from 2.5 to 4.5 years; though there are no significant sex differences, the girls are in general slightly ahead of the age trend.

2. More determiners, numeratives, and corresponding pronouns are found at successive ages from 2.5 to 4.5 years, but the proportion of these words to the total number of words remains fairly constant. There are no significant sex differences. Numeratives, very infrequent at 2.5, are very rapid in their development.

3. There are significant increases in the number of places filled on the tabulating sheet. The number of places filled has a fairly high positive correlation (rho = +.32 to .83) with the number of words in 100 responses, and a slightly higher correlation (rho = +.45 to .89) with the number of words tabulated (i.e., determiners, numeratives, and corresponding pronouns).

4. Both definite and indefinite determiners, not including articles, increase in number from 2.5 to 4.5 years. Proportions of definite and indefinite adjectives show an age trend in the direction of relatively fewer definite adjectives and more indefinite adjectives.

5. The growth curve for the frequency of "a" levels off from 3.5 to 4.5 years, but the curve for "the" shows a rapid rise from 2.5 to 4.5 years. The proportions of "the" to "a" show an age trend in the direction of an increase in the proportion of "the", reaching 48.3 per cent of the total at 4.5 years.

6. When all determiners are pooled, the proportions of definite to indefinite determiners remains fairly constant. There is a slight age trend in the percentage of the total words comprised by determiners, the percentage rising from 6.7 at 2.5 to 8.8 at 3.5 years.

7. The pronoun usage of determiners used as pronouns by class cleavage decreases markedly with age, especially in the indefinite category. Relatively to the age trend, the girls were behind the boys at all ages.

8. The frequency of descriptive adjective phrases increases markedly with age; the girls are behind the age trend at 2.5 but their responses increase in frequency more rapidly than the boys' thereafter.

9. In the case of "the" and "a", there are relatively more articles used in the "controlled" situation, but situation does not markedly affect the relative frequency of "the" and "a" to each other.

10. An attempt is made to outline the processes involved in the learning of the determiners, numeratives and other "indicaters" studied here, using the principle of differentiation from phrase-wholes.

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THE MEASUREMENT OF ATTITUDES OF DELINQUENT AND NORMAL BOYS BY USE OF AN ASSOCIATIONAL TECHNIQUE[1]

WILLIAM FAUQUIER

It is generally well agreed among clinicians working in the fields of child development that the roots of juvenile delinquency are to be found in the past adjustmental struggles of the child and that the conflict basis of an individual's behavior is correlatable with his attitudes toward present life situations which relate themselves directly or indirectly to his particular problems.

If as Sherman believes, "The motivating force of attitudes arises in an attempt to solve a given problem,"(7, p. 48), we would expect from maladjusted boys, especially from those whose conflict solving attempts have brought about their placement in a corrective institution, different and stronger attitudes than from normal individuals. Moreover if we attempt to differentiate the tractable from the intractable boy, a dissimilarity among the delinquents themselves would be anticipated.

Assuming this to be true, delinquent boys should differ from one another and from their better adjusted fellows in terms of their hates, fears, loves, and desires. This paper reports an investigation of this assumption.

METHOD

To obtain a sampling of attitudes the conventional questionnaire and interest inventory were rejected in favor of a simple associational method because, as Sherman has pointed out in his study of the development of attitudes, "The very measurement of an individual's attitude requires a method whereby the factors of truth and cooperation will influence the results as little as possible. We can see readily that in a normal social situation an individual will develop inhibitions and distortions in order to maintain his prestige at as high a level as possible. Children, and adults as well, often reply to a question in a manner which they believe will be acceptable to the examiner. Therefore," he concludes, "the questions usually must be inferential and not direct."(6)

Among recent studies of children's attitudes which have utilized an inferential method, the work of H. Meltzer (5) is important. Meltzer realized that it was impossible to obtain an accurate picture of children's identifications with their parents through the ordinary questionnaire method. So he devised a free association test in such a way that the individuals examined did not realize the significance of their responses.

Believing Meltzer's method to be substantially more reliable than either the questionnaire or the interest inventory, a modified form of his test was used. The subjects were instructed to write quickly their seven first associations to each of four stimulus words - hate, fear, love, desire. It was originally assumed, and later substantiated by the results, that these stimuli would elicit responses representative of general attitudes and indicative of basic conflicts.

The associated responses were first tabulated into specific and non-specific words; as far as possible the specific data were then broken down into qualitative categories. All words having personal reference and a few words listed as "meaningful", which lend themselves to classification, were utilized.

CHARACTERISTICS OF GROUPS USED IN STUDY

The subjects consisted of 86 delinquent boys comprising the vocational and upper grade classes of the institution, and 40 normal boys who were picked at random from a neighboring public grade and highschool. For purposes of more meaningful comparison the delinquent boys were divided into two distinct groups 1) the institutionally maladjusted and 2) the institutionally adjusted.

[1] *This study was conducted at Berkshire Industrial Farm, Canaan, N. Y.*

This division was based on a purely quantitative measurement of the individuals' adjustment during a period of six months prior to the study. It is necessary to explain that a very accurate day by day conduct record[2] had been kept for all individuals making it possible to summarize at any time the behavior of each boy in the school. By determining the mean and median number of misconduct reports for the total population,[3] it was possible to classify each individual in the study into either one of the two groups.

For convenience of recording, the institutionally maladjusted group will be represented by the symbols I-MA; the institutionally adjusted group by I-A; and the normal control group by N-C.

TABLE 1

MEDIAN AND MEAN NUMBER OF CONDUCT REPORTS FOR MISBEHAVIOR FOR THE TWO GROUPS OF INSTITUTIONALIZED DELINQUENTS

Group	Number of conduct reports		Number of boys in group
	Median	Mean	
I-MA	11.60	13.50	44
I-A	2.67	2.85	42

Besides the I-MA boys' greater resistance to routine, they have a higher incident of conduct difficulties mentioned by the agencies which committed them.

TABLE 2

REASONS MENTIONED IN COURT RECORDS FOR THE COMMITMENT OF BOYS IN THE TWO DELINQUENT GROUPS

Group	Reasons mentioned					
	Stealing	Disobedience, antagonism and insolence	Desertion of home	Truancy from school	Other reasons	Total reasons mentioned
I-MA	29	30	16	24	15	114
I-A	25	59	11	11	12	88

"Desertion of home" and "Truancy from school" considered together occurs nearly twice as frequently for the I-MA group, but "Disobedience and behavior problems" is conversely only half as great as for the I-A group. "Stealing" is approximately the same for both groups although most of the I-MA boys' stealing occurred out of the home which was not typically the case of the individuals in the I-A group.

TABLE 3

MEDIAN I.Q.,[4] AGE, AND GRADE;[5] HOME STATUS, AND NATIVITY OF PARENTS OF BOYS IN THE THREE GROUPS

Group	Median I.Q.	Median age	Median grade	Per cent of boys from broken homes	Per cent of foreign born parents	Number in group
I-MA	94	14-0	7.3	68	20	44
I-A	94	15-5	7.0	81	21	42
N-C	90	15-5	8.7	33	20	40

[2] *Reports of misconduct are sent into the administrative office each day. At the end of each month they are tabulated for each individual according to type.*

[3] *The range of conduct reports for six months is from 0-77.*

[4] *The Revised Stanford-Binet Scale was used exclusively as the mental criterion for the institutional groups. The Hanmon-Nelson Tests of Mental Ability for the normal control group.*

[5] *Grades for the normal-control group are actual; those for the institutional groups were estimated by the New Stanford Achievement Test.*

The median I.Q. of the three groups is for all purposes identical. Unfortunately the difference in age between the I-MA and the other two groups could not be avoided if the institutional boys were to be divided solely on the basis of their conduct record. The grade placement of the three groups reflects the general retardation of the institutional boys. Many of them, however, especially those comprising the slightly older I-A group, left academic school after the completion of 6th grade; their educational lag being in part the results of vocational training with an emphasis on trade subjects.

In many ways the I-MA group resembles Healy's typical antisocial type delinquent while the I-A more closely approximates his neurotic type. Certainly the I-MA are more aggressive, less tractable, and present more serious conduct problems. The majority of the I-A individuals show an unmistakable desire to please, are less extrovertive and have fewer conduct difficulties.

QUANTITATIVE RESULTS OF ASSOCIATION TEST

The associations of the three groups to the four stimulus words are tabulated in Table 4 into specific and non-specific responses.

TABLE 4

SPECIFIC AND NON-SPECIFIC RESPONSES OF THREE GROUPS TO FOUR STIMULUS WORDS[6]

Group	Specific responses						Non-specific responses													
	Personal reference		Meaningful		Total		Synonym		Antonym		Rhyme		Perseveration		Phrase		Nonsense		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
I-MA	265	32	221	26	486	58	158	19	12	1	18	2	36	4	64	8	59	7	347	41
I-A	247	30	238	29	485	59	133	16	24	3	42	5	36	4	46	6	63	8	344	42
N-C	328	37	200	23	528	60	88	10	29	3	39	4	27	3	28	3	148	17	359	40

There is no significant quantitative difference between the three groups. If we use the formula

$$\frac{\text{Total number of associated responses of group}}{7 \times 4 \times \text{number of boys in group}}$$

we find that the I-MA group gave 68 per cent of the total possible responses, the I-A 69 per cent, and the N-C 79 per cent. This would seem to be indicative of better cooperation and a more spontaneous type of association with less blocking by the normal control group. On the other hand, the high percentage of nonsense responses by the N-C group may also be representative of blocking.

QUALITATIVE RESULTS OF ASSOCIATION TEST

Preliminary analysis of the specific responses led to the selection of a few categories under which all the responses to any single stimulus word could be conveniently classified. These categories were kept as inclusive as possible because it was believed that the associated words did not warrant detailed classification. For example, the specific responses to the stimulus hate were found to be classifiable under four headings, 1) hate of objects; 2) hate of situations; 3) hate of persons, and; 4) violence as a reaction.

Under "hate of objects" fell such knowns as "doll, fish, dog, devil, money, medicine".[7] In the category "hate of situation" words such as "life, hell, anger, discourteous, and meanness" (which evidently indicate situations which the individual disliked or resented) were included. Nouns and pronouns such as "pal, boy, friend, rebel, enemy, you, him" were placed under "hate of persons".

[6] *The percentages in this table, being crude, are reduced to closest whole numbers.*

[7] *All the classification work was done by the writer insuring the maximum possible homogeneity.*

"Violence as a reaction" included all words indicating or implying physical action-against as typified by such verbs as "fight, kick, murder, torture, smack, hit, knock"; it being assumed that reactions of this type represented an immature and antagonistic tendency to react with overt violence to frustration.

The following four tables summarize the responses to the four stimulus words. They are presented in the order in which the stimuli were given. The differences between the three groups are briefly stated beneath each table with further comment reserved for summary discussion.

DISCUSSION OF FINDINGS

The associated responses given by the three groups are marred by no serious discrepancies which suggest that they are spurious. In most instances the trends shown by the statistics, at least in regard to the institutional groups, are verifiable by long time observation of the boys.

The attitudes as reflected by the responses of the I-MA group apparently indicate stronger drives toward personal security symbols and adequacy rewards. Table 5, column D, demonstrates this group's tendency to react violently to frustrating situations and suggests their antisocial nature. In this instance Sherman's opinion that, "The more insecure the individual feels, the more emotionally toned and stronger are his attitudes" (6, p. 41) seems verified by the responses in this study. Moreover it is everyday observable that the I-MA group of boys are unhappy, hyperactive, disorganized, and bully their weaker companions. On occasion they attempt violence not only upon one another but on adult members of the staff whose jobs bring them into antagonistic relations with the boys. Antisocial behavior, feelings of persecution, runaway, and anger reactions are the typical rather than occasional patterns of this group.

Carr has suggested that anger is conducive to a vigorous, aggressive, and determined type of attack; and, further, that anger is correlated with aggression while fear is associated with the opposite type of behavior (3). This may partially explain why the I-MA group express a greater tendency to react with overt violence, being as they are untrained to inhibit anger. They also express greater "hate of persons" toward whom they react habitually with insolence and spite.

TABLE 5

QUALITATIVE DIFFERENCES IN RESPONSE TO STIMULUS HATE

Group	A Hate of objects		B Hate of situations		C Hate of persons		D Violence as reaction		E Total number responses
	N	%	N	%	N	%	N	%	
I-MA	10	13	7	9	25	33	33	44	75
I-A	12	19	19	29	16	25	18	28	65
N-C	20	28	26	37	11	15	14	20	71

A. The N-C group shows a greater "hate of objects" than the other two groups. The I-A shows a similarly greater "hate of objects" than the I-MA group.

B. The N-C group shows a proportionally greater "hate of situations" than the other two groups. The I-A group shows a similarly greater "hate of situations" than the I-MA group.

C. The I-MA group shows greater "hate of persons" than the other two groups and the I-A greater than the N-C group.

D. The I-MA shows an astonishingly greater "violence as reaction" than the other two groups and the I-A shows slightly more "violence as reaction" than the N-C group.

TABLE 6

QUALITATIVE DIFFERENCES IN RESPONSES TO STIMULUS FEAR

Group	A Fear of animals		B Fear of situations		C Fear of Objects and persons		D Fear of Illness and death		E Total no. responses
	N	%	N	%	N	%	N	%	
I-MA	16	24	28	42	17	25	6	9	67
I-A	9	17	18	33	21	39	6	11	54
N-C	4	5	41	48	38	45	2	2	85

A. The I-MA group shows greater "fear of animals" than the other two groups and the I-A shows greater "fear of animals"[8] than the N-C group.

B. The N-C group shows greater "fear of situations"[9] than the other two groups. The I-MA group shows greater "fear of situations" than the I-A group. The N-C group shows greater "fear of situations" than the two institutional groups together.

C. The N-C group shows greater "fear of objects and persons"[10] than the other two groups. The I-A group shows greater "fear of objects and persons" than the I-MA group.

D. The I-A group shows greater "fear of illness and death"[11] than the other two groups. The I-MA group shows similarly greater "fear of illness and death" than the N-C group. The institutional groups together show relatively greater "fear of illness and death" than the N-C group.

Conversely, the fears of the I-MA group as listed in Table 6, column C, indicate that they have less "fear of objects and persons" than the I-A and N-C groups. If, as Carr suggests, fear is associated with a submissive type of behavior, this table is explanatory in some degree as to why the I-A and N-C groups react more in accordance with the will and direction of others; it being implied that respect, cooperation, obedience, and fear are closely related as motives governing social behavior.

Observation of the institutionalized boys during the last year and a half has impressed the writer that the timid and fearful individuals are most frequently the ones who try to please others, adults particularly. On the other hand the boys of the I-MA group who frequently run away, sleeping in barns, in deserted houses and haystacks, and who actually enjoy the pursuit of staff, citizens, and police alike, are not basically afraid of people or objects.[12]

Why the I-MA and I-A groups show relatively less "hate of situations" than the N-C group is difficult to explain unless one defends the notion that the delinquent boy is occupied more with concrete things and little, if at all, with abstractions such as life, anger, hell, etc. This is to say that the hates of the I-MA and I-A groups are probably more complicated, elaborated, and symbolized than those of the N-C group.

It is also puzzling why the I-MA and I-A groups should express greater "fear of animals" than the N-C group as all the boys live in a rural section where there is daily necessity of becoming acquainted with wild and domestic animals.

[8] *Fear of animals, as: dog, gorilla, lion, snake, etc.*

[9] *Fear of situations, as: fight, danger, dark, nerves, home.*

[10] *Fear of objects and persons, as: ghost, image, knife, guns, man.*

[11] *Fear of illness and death, as: dying, death, cancer, heart, weak, leprosy.*

[12] *In the unpublished study already cited, in reply to a question relating to attitudes toward participation, 50 per cent of the I-MA group, 60 per cent of the N-C group, and 70 per cent of the I-A group admitted feeling inferior when playing in competitive games. This corroborates the notion that the I-MA boys are more aggressive and the I-A boys more fearful and submissive.*

TABLE 7

QUALITATIVE DIFFERENCES IN RESPONSE TO STIMULUS LOVE

Group	A Persons loved		B Sports loved		C Animals loved		D Other things loved		E Total Number responses
	N	%	N	%	N	%	N	%	
I-MA	46	64	8	11	3	4	15	21	72
I-A	36	55	0	0	11	15	19	29	66
N-C	32	34	4	4	11	12	48	50	95

A. The I-MA group shows greater "love for persons"[13] than the other two groups. The I-A group shows slightly "greater love for persons" than the N-C group.

B. The I-MA group shows greater "love of sports"[14] than the other two groups. The N-C group shows more "love of sports" than the I-A group.[15]

C. The I-A group shows greater "love of animals"[16] than the other two groups. The N-C group shows greater "love of animals" than the I-MA group.

D. The N-C group shows greater "love of other things"[17] than the other two groups. The I-A group shows slightly more "love for other things" than the I-MA group.

TABLE 8

QUALITATIVE DIFFERENCES IN RESPONSE TO STIMULUS DESIRE

Group	A Desire for persons		B Desire for possession		C Desire for attainment of goal		D Total no. responses
	N	%	N	%	N	%	
I-MA	10	13	25	33	41	54	76
I-A	7	8	46	56	30	36	83
N-C	6	7	46	52	37	42	89

A. The I-MA group shows a greater "desire for persons"[18] than the other two groups. The I-A and N-C groups show almost an identical preference.

B. The I-A group shows a greater "desire for possession"[19] than the other two groups. The N-C group shows a significantly greater "desire for possession" than the I-MA group. The N-C group shows greater "desire for possession" than the two institutional groups taken together.

C. The I-MA group shows greater "desire for attainment of goal"[20] than the other two groups. The N-C group shows a slightly greater "desire for attainment of goal" than the I-A group but less than the two institutional groups taken together.[21]

[13] *Persons loved, as: sweetheart, girl, father, friends, aunt.*

[14] *Sports loved, as: football, swimming, basketball, etc.*

[15] *In an unpublished study entitled "Attitudes Toward Athletics of Well Adjusted and Poorly Adjusted Grade and Junior High School Boys" in which nearly the same individuals were used, 38 per cent of the I-MA group listed a sport as their favorite hobby as compared to 35 per cent of the N-C and 24 per cent of the I-A. In reply to another question of the same questionnaire 83 per cent of the I-MA, 78 per cent of the I-A, and 85 per cent of the N-C groups responded that they liked sport "very much".*

[16] *Animals loved, as: cat, dog, horse, etc.*

[17] *Other things loved, as: personality, books, flowers, moonlight.*

[18] *Desire for persons, as: mother, father, sister, aunt, etc.*

[19] *Desire for possession, as: dollar, bicycle, football, car, dog.*

[20] *Desire for attainment of goal, as: win, promotion, discharge, carpentry (assignment to), home, success, job, rich, etc.*

[21] *In the unpublished study mentioned 71 per cent of the I-MA group, 58 per cent of the I-A and 44 per cent of the N-C indicated in some degree a desire to win above mere playing for the sport of a game. This would seem to confirm the figures of column C above.*

Speer in a previous study[22] in which he used many of the same individuals (9) showed 41 per cent of his "truant group" and 20.6 per cent of his "theft group" as expressing a fear of animals in his questionnaire. While his figure is considerably higher than the one indicated in this study, it nevertheless substantiates the fact that the institutional boy is concerned with a fear of animals. Whether this is symbolic or merely represents an imitated language attitude rather than expressing actual timidness is problematic. Speer suggests the fear of animals as being identical with, or related to, a fear of bodily injury. Possibly the greater mental turmoil and deeper conflicts of the I-MA boys make for imagined fear of formidable animals such as the lion, tiger, snake, and gorilla.

The more evident "fear of illness and death", observed also by Speer in similar frequencies, is suggestive of a greater neurotic concern with somatic complaints by the delinquent boys.

In Tables 7, column A, and 8, column A, the I-MA group demonstrates greater love for and need of persons than the I-A and N-C groups. This, it must be remembered, is coincidental with a greater "hate of persons", Table 5, column C. These stronger attitudes may reflect the direction of the I-MA boys' conflicts as these individuals seem in greater need of affection and recognition. That 75 per cent of the I-MA group's associations to the stimulus love resolved themselves into either an expression of "love for persons" or "love of sports" seems to verify this belief.

The I-MA group's lesser "love of animals", Table 7, column C, seems to corroborate his greater "fear of animals", Table 7, column A. While this attitude does not appear to be especially important, it contributes however to a more general understanding of the maladjusted individual.

In Table 8, column C, the I-MA group shows a greater "desire for attainment of a goal" than the I-A and N-C groups. This apparently demonstrates a more energetic motivation on their part to win and maintain status through some applauded end.[23]

Speer's study showed 23.6 per cent of his "truant group" and 20.5 per cent of his "theft group" expressing wishes for material things while 68 per cent of his "truant group" and 62.9 per cent of his "theft group" indicated a desire "to be someone" or "to do things". These figures compare favorably with the responses summarized in Table 8. The N-C and I-A groups indicate greater "desire for possession" than the I-MA group. Among the institutionalized boys stealing is proportionally lower for the I-A group than for the I-MA group. It is permissible to venture that the "desire for possession" parallels closely the development of a mature realization of and respect for property rights which for obvious reasons is lacking in the antisocial boy. It may be asked whether these figures do not add evidence to disprove the still popular theory that the delinquent steals primarily because of an uncontrolled desire for possession.

Table 8, column A, emphasizes the identification and involvement of the I-MA group with people, and perhaps intimates his insecurity and the direction of some of his conflicts. That the N-C group voiced 50 per cent of their responses to the stimulus love for "other things loved" as compared to 29 per cent of the I-A group and 20 per cent of the I-MA group, appears to be convincing evidence of the broader interests and more mature outlook of the former. The social isolation of the institutional boy undoubtedly has much to do with the restriction of his interest to people and sports.

[22] *This study was conducted at Berkshire Industrial Farm and used many boys included in this study.*

[23] *In the author's unpublished study already mentioned 71 per cent of the I-MA group, 58 per cent of the I-A, and 44 per cent of the N-C group indicated a desire to win above mere playing.* *(See footnote 21 on page 236).*

SUMMARY AND CONCLUSIONS

From the institution's population of 150 boys, 86 were given an association test requiring seven responses to each of four stimulus words - hate, fear, love, desire. For better comparative purposes two groups of identical intelligence and nearly equal age were formed, the I-MA and the I-A groups. This classification was made on the basis of behavior as objectively measured by the number of conduct reports for misbehavior received by each boy during six months prior to study. For control a group of normal boys of approximately same age and intelligence were similarly tested.

The associated responses of the three diverse groups were tabulated and arranged in tables. There was little difference in the nature of the specific and non-specific replies. A qualitative treatment of the specific data indicated attitudinal differences as reflected by the nature of the associations.

The specific responses of the I-MA suggest that they have greater love and hate of persons and that they are more closely identified with activities bringing immediate and concrete satisfactions. They voice greater concern with the desire to attain individual goals and as a group stand out from the I-A and N-C groups in regard to the direction, strength, and fixation of their attitudes. Their responses seem also to indicate resentment toward, dislike and distrust of people; a significant prevalence of abnormal fear of animals and illness; a stronger drive for security and prestige; less ability to inhibit violent overt reactions; and a greater need of affection as shown by their stronger love of and desire for people.

The I-A group shows many of the same attitudes of the I-MA group but to a markedly less degree. They voice more interest in possession and show about half the tendency to react violently. They have less fear, hate, and need of people. In general their responses suggest more social maturity and better social adjustment. They compare favorably with the N-C group, but stand out as distinct from it.

In nearly every instance the responses of the N-C group prove them to possess a higher level of emotional maturity and socialization with less evidence of abnormal fears and conflicts.

The general findings of this study suggest basic differences between the attitudes of the I-MA and I-A groups and those of normal individuals. There is indicated further a marked dissimilarity among the institutional boys which should be investigated to discover if possible the correlations between environmental factors, specific institutional behavior, and attitudinal patterns.

APPENDIX

DETAILS OF ADMINISTRATION OF ASSOCIATION TEST

Each pupil is handed a piece of bond paper. "This is a test to see how you think. Its results will not be counted in any of your marks. Everyone must remain absolutely quiet because any noise or talking out loud will spoil the score. Listen carefully to what we are going to do. Fold the paper in half making four sections. Write numbers from one to seven down the left hand margin of each section of the paper making four sets of seven numbers. . . Now listen! I am going to say a word like joy or sad and you are to write the first seven words that come into your mind, which my word makes you think of. Do not stop or look around to figure out the words, but write them as fast as you can and they will come to you.

"Get ready..... The word is 'HATE'---- hate.
"Now turn to the space below and get ready for the next word.....
"Get ready..... The word is 'FEAR' ---- fear.
"Now turn over to the top space on the other side of the paper.
"Get ready..... The word is 'LOVE' ---- love.
"Now turn to the last space on the paper.
"Get ready..... The word is 'DESIRE' ---- desire.
"Be sure your name is on the paper. Do not add any words or you will spoil your score."

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DRY SKIM MILK IN LOW COST DIETS[1]

ELEANOR P. HUNT[2]

INTRODUCTION

Milk is a nearly complete food, furnishing proteins of high quality, essential minerals in easily assimilable form, and several of the vitamins as well as other nutrients. It is widely accepted that unless there are specific contraindications, the diet of young persons should contain liberal daily allowances of milk (30). At present a large part of the population of the United States is consuming less milk than is generally regarded as adequate for optimum growth and vigorous health (29). Among families whose food expenditures are moderate or liberal, the problem of adequate milk consumption is largely an educational one. In low income groups, in which the money expended for food is greatly restricted, improvement of the diet through the extension and increase of milk consumption, while still dependent upon intelligent food selection, is more closely related to the availability of inexpensive forms of milk. Dry skim milk affords a number of economies which greatly reduce the cost of milk solids other than fat to the consumer. The use of dry skim milk in the diet increases the mineral and vitamin intakes with relatively small addition to the food expenses.

Although dry skim milk contains practically none of the fat of whole milk, and its vitamins A, C, and D contents are negligible, it provides, unimpaired, the solids other than fat of fresh milk as well as vitamin B and riboflavin (vitamin G). The transportation and delivery costs of milk solids in the form of dry skim milk are significantly less than those of milk in the fluid form as practically all of the water has been removed. The product can be stored unrefrigerated for considerable periods of time without deterioration. Experiments in the Bureau of Dairy Industry have shown that inexpensive packaging in laminated-glassine-lined paper bags gives adequate protection for 5 weeks when kept at 73°F. in an atmosphere having a relative humidity of from 85 to 95 per cent. In such a container, or similarly protected, dry skim milk can be stored in the home without refrigeration.

Dry skim milk has been widely used industrially in bread making and in the manufacture of candy, confectionery and ice cream. Brands tested by the United States Public Health Service have been found to yield a reconstructed milk, which, under a pediatrician's supervision, can be used as a safe and satisfactory substitute for fluid milk in infant feeding (5, 27). Roberts, Carlson, and MacNair, in a study of institutional diets, reported significant improvement in the quality of the diets, through dry skim milk supplements to the customary fluid milk supply of the institution (17). With small addition to the food expense the calcium and phosphorus intakes of nursery school children were increased by the use of dry skim milk in cooking and as added solids in milk served as a beverage (12).

Supplements of 2 to 4 ounces per person per day of dry skim milk have been found "to reduce greatly the incidence of pellagra among families which, in times of stress, subsist on a very monotonous and one-sided diet, containing very little

[1]*This study was supported by an allotment of funds from the Agricultural Adjustment Administration, U. S. Department of Agriculture, to investigate the expansion of the market for dry skim milk for human consumption.*

[2]*Formerly Associate Anthropometrist, Bureau of Home Economics, U. S. Department of Agriculture, Washington, D. C.* *The author acknowledges gratefully the collection and preliminary analysis of the dietary data under the supervision of Martha Koehne, formerly Home Economics Specialist, Bureau of Home Economics, and the measurement of the children participating in this study by W. Montague Cobb, M.D., Associate Professor of Anatomy, Howard University, and formerly Medical Officer, Bureau of Home Economics.*

milk, lean meat, fish or eggs" (24). Recently dry skim milk has been extensively used to fortify the diets of families receiving public assistance. During the years 1935 and 1936, the Federal Surplus Commodities Corporation provided 16,573,329 pounds of dry skim milk to relief agencies in 26 states and the District of Columbia for local distribution among relief clients. Approximately 85 per cent of the total quantity was distributed to homemakers. Fifteen per cent was used in the preparation of school lunches. In many of the States the distribution of dry skim milk was accompanied by an educational program dealing with its uses in simple cooked dishes and in beverages. During the year 1937, 22,848,000 pounds of dry skim milk were distributed by the Federal Surplus Commodities Corporation to 39 welfare agencies in 38 states and the District of Columbia.

The present study was undertaken to appraise more fully the dietary effects of dry skim milk supplements in low-cost diets, and to obtain if possible, during the short term of the study, a measurement of the nutritional effects of increasing the milk solids other than fat in diets deficient in milk products.

PLAN OF STUDY

A group of 213 preschool Negro boys in the District of Columbia constituted the sample. The age range of the children was from 30 to 54 months. They were from low income families which were purchasing small amounts of milk products. Children were selected whose daily estimated milk consumption did not exceed approximately a cup of fluid milk or its equivalent in milk products, exclusive of butter and cheese. The estimates were made in the home by field agents at the time of the initial interview with the mother. The diet records indicated that the milk consumption of approximately 80 per cent of the children selected did not exceed the maximum level set for selection. The remainder of the children exceeded this level somewhat but neither regularly nor to an extent which was considered sufficient to prevent their inclusion in a low-milk-consumption group.

The children lived at home and none attended nursery schools. Families were selected in which the mother or guardian prepared all of the child's meals and was willing to keep the necessary diet records. The children were divided on a geographical basis into a control group and a demonstration group. Figure 1 shows the distribution of the families of the two groups, which were nearly equal in size. The geographical basis of division was adopted to minimize contacts between the demonstration and control families. It served this purpose successfully.

The families of the demonstration children received throughout the period of the study regular supplements of dry skim milk. Dry skim milk manufactured by the spray process was supplied. Laboratory tests in the Food Utilization Division of the Bureau of Home Economics had indicated that the spray process yields a product which gives excellent dispersion and has a desirable flavor.

The study was conducted during the period February to July, 1936 by the Bureau of Home Economics in cooperation with the Departments of Anatomy and Biochemistry of Howard University, Washington, D. C. Active field work was carried on for 141 days.

At the opening of the study in February 1936, all of the children were given a physical examination. This was repeated at the close of the study in June 1936. The second examination of each child took place at approximately the same hour of the day as the first. The order in which the children came for examination in February was repeated in June so far as possible. The examination included body measurements and X-rays of the right hand as well as a clinical examination

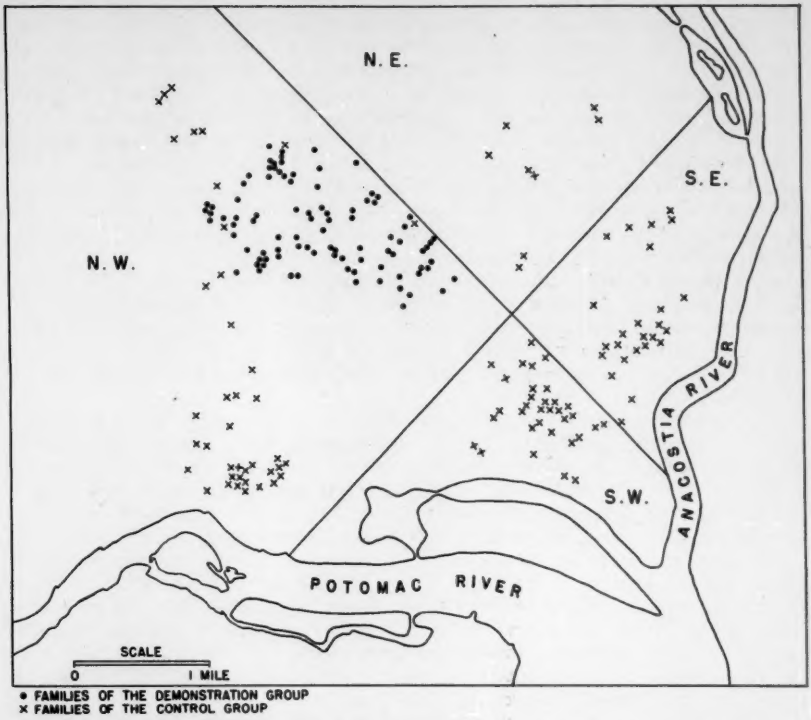

Fig. 1. Distribution of the demonstration and control families in Washington, D. C.

with determinations of hemoglobin, red cells and serum calcium and phorphorus. The X-ray findings and blood studies will be discussed in later reports.

As the period of the study was brief, the measurement of nutritional effects was limited. It was practicable to consider only increments of stature. Stature could be measured with small error and that measurement shows progressive growth rather than the wide fluctuation which characterizes short term changes in weight and musculature.

During the study, measured-diet records for each child were obtained. In addition, family milk-consumption records were kept by the homemakers. These records were kept by the homemaker with the assistance of a member of the field staff of the study. The field workers were so routed that each home was visited on the opening and closing day of all records. Additional home visits were made when the accuracy of particular records required closer supervision. Each measured-diet and milk-consumption record covered a period of seven days.

The measured-diet record provided a count of the number of measures of each kind of food eaten by the child studied during the record week. The homemaker was provided with a standard measuring cup and instructed to use this measure for serving certain foods. Other foods served to the child were measured by tablespoon or teaspoon as instructed, or were reported by the number of pieces

served. The measures reported were subsequently converted into servings. The 3-meal-a-day pattern of feeding prevailed with some exceptions in the homes of the children. A serving at any meal of each food reported was defined as the volume, in cups, tablespoons or teaspoons, etc., which was considered reasonable and consistent with good usage in the feeding of children of preschool age. The measured-diet records enumerated the foods occurring in the diets and described their frequency of use. Two measured-diet records, taken during two different weeks of the study, were obtained for almost all of the children. In some cases 3 records were obtained. In a few cases only 1 measured-diet record was secured. The average of all of the records for any one child was considered representative of the customary dietary practice of the particular child.

The family milk-consumption records reported the total amount of all forms of milk, including dry skim milk, consumed by the family during the record week. Records covering 2 weeks of the study period were obtained for practically all families. A few families provided records for 1 week or for 3 weeks. The average of each family's records was taken as representative of its milk-consumption practice.

In addition to the measured-diet records, individual quantitative-diet records were obtained for 6 of the control children and for 11 of the demonstration children. Each of the quantitative-diet records covered a 7-day span and provided the weight in grams of all of the foods consumed by the child during the record week. In the quantitative-diet records the foods consumed were reported also by volume in cups, tablespoons and teaspoons, or pieces, thus furnishing a second type of measured-diet record called the converted-quantitative-diet records. The ingredients of mixed dishes were weighed before and after cooking, as was the portion of the mixed dishes eaten by the child. The small number of quantitative records was due to the inability of many mothers to assume the discipline in food preparation and service which accuracy in the records demanded. The time consumed by field agents in checking quantitative-diet records was considerable. Daily visits were made to the home.

A registered visiting nurse took the medical history of each child, and throughout the study period, by regular monthly visits to the homes, kept a record of each child's current illnesses.

From each household was obtained a detailed report of its composition, income, and housing facilities.

COMPOSITION OF THE DEMONSTRATION AND CONTROL GROUPS

Income, Housing and Family Composition. Forty-eight per cent of all of the families participating in the study were receiving direct relief or work relief.

The family dwellings were principally tenements or unaltered one-family houses occupied by several families. Kitchens and toilet facilities were frequently shared. From the record of the number of rooms occupied by each family it was estimated that not more than 7 per cent of the homes provided one room per person. Approximately half of the families were living with from 3 to 5 persons in one room.

In Table 1 the data on weekly income, housing and family size and age composition have been summarized for the demonstration and control groups. The weekly income of the two groups was \$16.45 $\pm$ \$7.20 and \$17.78 $\pm$ \$7.40 respectively. The families of the demonstration group ranged in size from 2 to 13 persons, and were closely paralleled by those of the control group with a range of 2 to 17 persons. The total number of persons in the average family was 7.0 $\pm$ 2.4 for the demonstration group and 7.9 $\pm$ 2.6 for the control group. The larger size of the control families was due to a slightly larger number of young chil-

dren and children 10 to 17 years of age.

The housing index was the ratio of the total number of rooms in the dwelling to the total number of occupants. The index was similar for the demonstration and control groups; 7.0 ± 2.4 and 7.9 ± 2.6 with a tendency for the control group to have a larger and more variable index.

No very satisfactory test could be made of the differences exhibited between the two groups as several of the distributions concerned are not normal. It was concluded in the absence of a more refined analysis that the slightly larger income of the control group was offset by the somewhat larger family size of that group. Relative to family size the housing index of the demonstration and control groups was regarded as comparable.

Body Measurements and Age. In Table 2 the demonstration and control groups of the 3-and-4-year-old series are compared for age in months, stature, weight, transverse breadth of chest and cristal breadth. The differences between the demonstration and control groups with respect to the means and variances for each variable can be explained by chance. The values for "Student's" t (10) and Snedecor's F (22) have been entered in Table 2 for each variable. None of the values is significant. The differences between the demonstration and control groups were such as might be expected in random sampling of a homogeneous population. Judged by age in months and measurements of length, breadth and bulk, the demonstration and control groups were comparable.

Prior Illness and Illness during the Study Period. The illnesses of the children prior to the opening of the study were reported on the medical histories which were taken by the registered visiting nurses. The histories were obtained from the mother or guardian. The incidence of measles, whooping cough, chicken pox, pneumonia, mumps, scarlet fever, spinal meningitis, and diphtheria in the demonstration and control groups, prior to this study, is summarized in Table 3. The experience of the two groups with respect to pneumonia, mumps, scarlet fever, spinal meningitis and diphtheria was similar. No clear-cut differences were evident between the demonstration and control groups with respect to other illnesses specified. Thus the incidence of measles was greater for the control group in the 3-year-old series, but it was greater for the demonstration group in the 4-year-old series. The same reversal was found for whooping cough. On the whole the records showed a close similarity in illness history rather than a reliable difference.

The records of current illness made by the field nurses during the study period indicated also similar illness experience for the demonstration and control groups. Table 4 shows the total number of child-days during which the groups were surveyed and the distribution of the survey days according to class of illness and freedom from illness. All diagnoses were those of the physician or nurse visiting either at the time of the illness or shortly after. Ambulatory cases of illness were ordinarily ignored by the mother so long as the child was out of bed. Fifteen to 18 per cent of the days surveyed fell under respiratory infections. During approximately one-fifth of the survey period the children of both groups experienced some illness.

DELIVERY AND USE OF DRY SKIM MILK

Immediately after the first physical examinations of the children, delivery of dry skim milk and instruction in its use were begun in the demonstration homes. The demonstration families received dry skim milk for approximately 113 days. The delivery policy was to supplement the regular milk supply with a sufficient amount of dry skim milk to provide each member of the family over 18 years of age with a total milk supply equivalent to 2 ounces per day of dry skim

TABLE 1

INCOME, HOUSING, SIZE AND AGE COMPOSITION OF THE FAMILIES OF THE DEMONSTRATION AND CONTROL GROUPS

Item	Weekly income		Housing index		Family Size and Age Composition							
					Total persons		Adults		Children 10-18 years of age		Children less than 10 years of age	
	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group
	Dollars	Dollars	No. of rooms per person	No. of rooms per person	Number	Number	Number	Number	Number	Number	Number	Number
Mean	16.45	17.78	0.5	0.7	7.0	7.9	2.8	2.8	0.8	1.6	3.4	3.6
Standard deviation	7.20	7.40	0.2	0.31	2.4	2.6	1.5	1.3	1.1	1.4	1.3	1.4
Median	--- 1/	--- 1/	--- 1/	--- 1/	7	8	2	2	0	1	3	4
First quartile	--- 1/	--- 1/	--- 1/	--- 1/	5	6	2	2	0	0	2	3
Third quartile	--- 1/	--- 1/	--- 1/	--- 1/	8	9	3	3	1	3	4	4
Range	5.00-45.00	0.00-50.00	0.2-1.5	0.3-2.0	2-13	2-17	1-8	1-9	0-5	0-5	1-7	1-7
No. of families reporting	92 2/	106	96	106	96	106	96	106	96	106	96	106

1/ Quantities not calculated.
2/ Does not include four families who gave incomplete data.

TABLE 2

AGE IN MONTHS, STATURE, WEIGHT, TRANSVERSE BREADTH OF CHEST AND CRISTAL BREADTH OF THE CHILDREN OF THE DEMONSTRATION AND CONTROL GROUPS AT THE TIME OF THE FIRST PHYSICAL EXAMINATION

Item	Age		Stature		Weight		Transverse breadth of chest		Cristal breadth	
	Age series		Age series		Age series		Age series		Age series	
	3-years	4-years	3-years	4-years	3-years	4-years	3-years	4-years	3-years	4-years
	Months	Months	Centimeters	Centimeters	Kilograms	Kilograms	Centimeters	Centimeters	Centimeters	Centimeters
Mean										
Demonstration group	35.8	47.3	92.7	98.6	13.9	15.6	16.0	16.7	14.7	15.6
Control group	35.2	48.2	91.8	98.1	14.1	15.6	16.2	16.7	14.7	15.6
"Student's" t	.85	1.45	.85	.52	.49	0.00	1.18	0.00	0.00	0.00
Standard deviation										
Demonstration group	3.3	3.5	5.2	5.0	1.9	1.9	.7	.9	1.0	1.1
Control group	3.3	3.3	4.7	5.4	1.8	1.9	.8	1.1	1.1	1.0
Snedecor's F	1.05	1.12	1.22	1.20	1.07	1.08	1.34	1.46	1.21	1.04
Range										
Demonstration group	30.0-42.0	42.0-54.0	80.0-101.9	78.0-109.9	10.0-18.9	11.0-22.9	14.0-17.9	14.0-18.9	12.0-17.9	13.0-19.9
Control group	30.0-42.0	42.0-54.0	82.0-104.9	79.0-109.9	11.0-18.9	10.0-19.9	14.0-17.9	14.0-18.9	12.0-17.9	12.0-18.9
Number of cases										
Demonstration group	39	59	39	59	37 1/	59	39	59	37 1/	59
Control group	49	59	49	59	48 2/	58 2/	49	59	49	59

1/ Measurement not reported for 2 cases of this series.
2/ Measurement not reported for 1 case of this series.

TABLE 3

INCIDENCE OF SPECIFIED ILLNESSES AMONG THE CHILDREN IN THE DEMONSTRATION AND CONTROL GROUPS PRIOR TO THE STUDY PERIOD

Series and group	Total number of children	Children who have had specified illnesses															
		Measles		Whooping cough		Chicken pox		Pneumonia		Mumps		Scarlet fever		Spinal meningitis		Diphtheria	
	Number	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
3-year-old series																	
Demonstration group	41 1/	9	22.0	9	22.0	12	29.3	10	24.4	2	4.9	2	4.9	1	2.4	2	4.9
Control group	51 1/	25	49.0	17	33.3	15	29.4	13	25.5	5	9.8	2	3.9	0	0.0	2	3.9
4-year-old series																	
Demonstration group	61 1/	33	54.1	22	36.1	12	19.7	11	18.0	8	13.1	3	4.9	2	3.3	0	0.0
Control group	61 1/	30	49.2	18	29.5	23	37.7	13	21.3	10	16.4	2	3.3	0	0.0	0	0.0

1/ This group includes two children who did not return for second physical examination.

TABLE 4

ILLNESS AND FREEDOM FROM ILLNESS OF THE CHILDREN OF THE DEMONSTRATION AND CONTROL GROUPS BY AGE SERIES DURING THE STUDY PERIOD

Group and series	Cases	Total child-days surveyed	Days of illness						Days free from illness	
			Respiratory 1/		Other infectious diseases and miscellaneous illnesses 2/		All illnesses			
	Number	Number	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
3-year-old series										
Demonstration group	41 4/	4105	694	17	129	3	823	20	3282	80
Control group	51 4/	5214	936	18	180	3	1116	21	4098	79
4-year-old series										
Demonstration group	60 3/	5907	1062	18	226	4	1288	22	4619	78
Control group	61 4/	6271	955	15	290	5	1245	20	5026	80

1/ Common colds, earache, pneumonia, running ear, whooping cough.
2/ Chicken pox, diarrhea, diphtheria, measles, mumps, scarlet fever, severe accidents, skin eruptions.
3/ One case in this series did not return for second physical examination.
4/ Two cases in this series did not return for second physical examination.

milk and the younger members with the equivalent of 4 ounces per day of the supplement. A standing order of dry skim milk, based on the field worker's report of the family needs, was delivered weekly to the home and a receipt for each delivery was obtained from the mother. The field worker periodically estimated the purchase habits of the family. The dry skim milk supplement was increased if necessary to provide the balance of the milk solids other than fat, required to bring the family milk supply up to the desired level.

Analysis of the records of delivery of dry skim milk and of the records of milk purchases of the demonstration families showed that the milk supply during the period of delivery was sufficient to meet the needs of all children and most of the adults in the demonstration families. Throughout the study the field workers emphasized to the homemakers the importance of the use of the milk by the younger members of the families.

The 7-day family milk-consumption records provided evidence of the extent to which dry skim milk was used after delivery in the demonstration homes. For the 96 demonstration families 201 milk-consumption records were obtained. They showed that 3.5 $\pm$ 1.4 cups of dry skim milk per person per week were used in those families. The homemaker was instructed to measure (with the standard cup) the dry skim milk used during the week of the milk-consumption record. The average weight of 1 cup of dry skim milk was found to be 4.96 ounces, which yielded 1.869 grams of calcium. The average number of cups of dry skim milk, used per person per week, was sufficient to provide approximately 0.9 grams of calcium per day. Ninety per cent of the calcium provided daily from milk sources was derived from dry skim milk.

The relation of the calcium per day, provided by the total milk supply of the family to the daily calcium requirement of the family was indicated by the ratio of the supply and the requirement. The ratio was 1 when the daily calcium from the total milk supply was equal to the daily calcium requirement of the family. The average value of the ratio was 1.14 with a standard deviation $\pm$.36. The range of the ratio was .55 to 2.40. Twenty-five per cent of the families had ratios between .55 and .95. In calculating the daily calcium requirement of the family .68 grams of calcium per day were allowed each adult male. The allowance for adult females was .88 grams unless the individual was pregnant or nursing in which case an allowance of 1.2 grams was made. The daily requirement of children under 19 years of age was assumed to be 1.0 grams. Family members were weighted also according to the number of meals eaten at home and the length of residence in the home during the period of this study.

DIETARY EFFECTS OF DRY SKIM MILK SUPPLEMENTS

Frequency Patterns of Food Usage. Measured-diet records were obtained for 101 children of the demonstration group and 112 children of the control group. In each group the records of the 3-year-old and 4-year-old series were combined. The descriptions of the diets as reported in the measured-diet records concerned the kinds of foods supplied the child and the frequency with which servings of these foods were eaten. Exact information as to the amounts of the various foods eaten was not provided by the measured-diet records. The records were useful in defining the frequency patterns of food usage, which characterized the diets of the demonstration and control groups.

Nine food categories were used to classify the servings per week of individual foods and mixed dishes. They were: Milk products exclusive of butter; fruits and vegetables exclusive of potatoes; legumes and nuts; meat, fish and poultry; butter and cod liver oil; potatoes; eggs; bread and cereals; desserts and sweets. Raw and cooked foods were included in the classes. Servings of

TABLE 5

FREQUENCY DISTRIBUTIONS FOR CALCIUM FROM MILK SOURCES AND FOR SERVINGS PER WEEK OF SPECIFIED CLASSES OF FOODS CALCULATED FROM THE MEASURED DIET RECORDS OF THE DEMONSTRATION AND CONTROL GROUPS

Calcium from Milk Sources				Class intervals of servings per week per child	Fruits and vegetables		Potatoes		Desserts and sweets	
Demonstration group		Control group			Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group
Class intervals:		Class intervals:								
Grams per day per child	Frequency	Grams per day per child	Frequency	Number	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency
---	---	.00 - <.05	10 1/	0 - < 2	---	1	7	11	1 1/	---
---	---	.05 - <.10	22 3/	2 - < 4	1	4	23 4/	23 3/	4	3
---	---	.10 - <.15	12	4 - < 6	4 1/	11	29 3/	31 2/	10	8
---	---	.15 - <.20	16 1/	6 - < 8	9	14 1/	21 2/	18 1/	10	17
---	---	.20 - <.25	18	8 - <10	13	13 2/	13 2/	15	13 3/	7 1/
---	---	.25 - <.30	9	10 - <12	15	15 2/	5	6	15 1/	15 1/
---	---	.30 - <.35	6	12 - <14	13 4/	16	0	5	11	21 3/
---	---	.35 - <.40	5 3/	14 - <16	10 1/	8	1	1	7 2/	17 1/
---	---	.40 - <.45	7	16 - <18	11 2/	7 1/	1	2	9 1/	10
---	---	.45 - <.50	0	18 - <20	3 1/	7	1	---	6 1/	4
---	---	.50 - <.55	0	20 - <22	4 1/	3	---	---	8 1/	2
---	---	.55 - <.60	3	22 - <24	5 1/	2	---	---	1 1/	3
.60 - < .80	7 1/	.60 - <.65	3	24 - <26	2	2	---	---	3	1
.80 - <1.00	14 3/	.65 - <.70	1	26 - <28	6	2	---	---	1	1
1.00 - <1.20	6	---	---	28 - <30	1	1	---	---	1	0
1.20 - <1.40	14 4/	---	---	30 - <32	2	2	---	---	0	1
1.40 - <1.60	5 1/	---	---	32 - <34	0	1	---	---	1	1
1.60 - <1.80	13 2/	---	---	34 - <36	2	2	---	---	---	0
1.80 - <2.00	13	---	---	36 - <38	---	0	---	---	---	1
2.00 - <2.20	8	---	---	38 - <40	---	0	---	---	---	---
2.20 - <2.40	8	---	---	40 - <42	---	0	---	---	---	---
2.40 - <2.60	4	---	---	42 - <44	---	0	---	---	---	---
2.60 - <2.80	5	---	---	44 - <46	---	0	---	---	---	---
2.80 - <3.00	1	---	---	46 - <48	---	0	---	---	---	---
3.00 - <3.20	0	---	---	48 - <50	---	0	---	---	---	---
3.20 - <3.40	1	---	---	50 - <52	---	1	---	---	---	---
3.40 - <3.60	0	---	---	---	---	---	---	---	---	---
3.60 - <3.80	0	---	---	---	---	---	---	---	---	---
3.80 - <4.00	1	---	---	---	---	---	---	---	---	---
4.00 - <4.20	0	---	---	---	---	---	---	---	---	---
4.20 - <4.40	1	---	---	---	---	---	---	---	---	---
Total	101	---	112	---	101	112	101	112	101	112
Median	1.67	---	.19	---	13.3	11.8	5.4	5.4	11.7	12.5
First quartile	1.14	---	.09	---	9.7	7.8	3.6	3.5	8.0	8.1
Third quartile	2.09	---	.28	---	18.0	16.8	7.6	8.1	17.1	15.5
Mean	1.68	---	.21	---	14.9	13.3	5.9	6.0	12.7	12.8
Standard deviation	.70	---	.15	---	7.1	8.1	3.1	3.4	6.4	6.0

1/ Quantitative diet record obtained for 1 case in this interval.
2/ Quantitative diet records obtained for 2 cases in this interval.
3/ Quantitative diet records obtained for 3 cases in this interval.
4/ Quantitative diet records obtained for 4 cases in this interval.

TABLE 6

FREQUENCY DISTRIBUTIONS FOR SERVINGS PER WEEK OF SPECIFIED CLASSES OF FOODS CALCULATED FROM THE MEASURED DIET RECORDS OF THE DEMONSTRATION AND CONTROL GROUPS

Class intervals of Servings per week per child	Legumes and Nuts		Meat, fish and poultry		Butter and cod liver oil		Eggs		Class intervals of Servings per week per child	Bread and cereals	
	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group		Demonstration group	Control group
Number	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Number	Frequency	Frequency
0 to < 1	21 6/	14	3	---	20 4/	17 3/	8 4/	18 3/	---	---	---
1 to < 2	17 4/	17	8 3/	3	11 4/	11	31 5/	33 3/	---	---	---
2 to < 3	21 5/	23 4/	3	4 3/	12	13	25 7/	27 3/	---	---	---
3 to < 4	7 3/	12 3/	5	5 5/	5 3/	3	10	10 3/	---	---	---
4 to < 5	14	21 4/	20 4/	12	14	20 3/	14	10 4/	---	---	---
5 to < 6	8	5 3/	10 5/	12	6 3/	10	2	3	---	---	---
6 to < 7	3 3/	10	14 5/	17 3/	7	6	6	8	12 - <16	3	1
7 to < 8	1	1	14	9 3/	3 3/	5 4/	3	1	16 - <20	1	5 3/
8 to < 9	7	1	15 3/	17	4	5 3/	1	1	20 - <24	8	12 4/
9 to <10	1	1	2 3/	5	2 3/	3	1	0	24 - <28	20 5/	12 3/
10 to <11	1	1	5	12	1	3 3/	---	1	28 - <32	14 5/	21 3/
11 to <12	---	1	1	5	1 3/	1	---	---	32 - <36	17 3/	12
12 to <13	---	3	1	5	3	2	---	---	36 - <40	9 4/	13
13 to <14	---	0	---	2	2	2	---	---	40 - <44	9	10 3/
14 to <15	---	1	---	2	4 3/	2	---	---	44 - <48	8	7
15 to <16	---	0	---	1	1	1	---	---	48 - <52	2	8
16 to <17	---	1	---	1	3	3	---	---	52 - <56	7 4/	2
17 to <18	---	---	---	---	0	0	---	---	56 - <60	1	4
18 to <19	---	---	---	---	0	1	---	---	60 - <64	2	4
19 to <20	---	---	---	---	1 3/	0	---	---	64 - <68	---	0
20 to <21	---	---	---	---	1	0	---	---	68 - <72	---	0
21 to <22	---	---	---	---	---	4	---	---	72 - <76	---	1
Total	101	112	101	112	101	112	101	112	---	101	112
Median	2.6	3.1	6.1	7.3	4.2	4.6	2.5	2.2	---	33.0	33.8
First quartile	1.2	1.8	4.3	5.3	1.5	1.9	1.6	1.3	---	26.6	27.4
Third quartile	4.7	4.8	7.9	10.0	7.2	7.8	4.1	3.7	---	41.7	43.5
Mean	3.2	3.9	6.0 1/	7.6 1/	5.4	5.8	3.0	2.7	---	34.7	35.8
Standard deviation	2.5	3.1	2.6 2/	3.2 2/	5.0	5.2	2.0	2.0	---	10.7	12.0

1/ Difference between the means is significant.
2/ Difference between the variances is significant.
3/ Quantitative diet records obtained for 1 case in this interval.
4/ Quantitative diet records obtained for 2 cases in this interval.
5/ Quantitative diet records obtained for 3 cases in this interval.
6/ Quantitative diet records obtained for 4 cases in this interval.
7/ Quantitative diet records obtained for 6 cases in this interval.

mixed dishes such as soups, sauces, stews and gravies were distributed among the appropriate classes, according to the customary recipes used by the homemakers. From the servings of milk in various forms an estimate was made of the daily calcium supply for each child. Thus milk-consumption is discussed in terms of calcium supplied daily. The consumption of other foods is discussed from the point of view of servings of the various foods per week. The frequency distributions for calcium from milk sources and the several food classes are shown in Tables 5 and 6. Table 7 summarizes the measures of central tendency and dispersion for each of the food classes and for calcium. "Student's" t and Snedecor's F were used to test the differences between the means and the variances of the demonstration and control groups for those food classes which appeared to have normal distributions. The values of t and F are shown in Table 7. The demonstration and control groups exhibited a large difference in milk consumption. The mean and standard deviation for calcium from milk for the demonstration group was 1.68 ± .70 grams per day per child. For the control group the corresponding values were .21 ± .15 grams per day. The ranges of the calcium distributions showed practically no overlapping. The range of the control group was .00 to .70 grams per day, of the demonstration group .60 to 4.40 grams per day. The average calcium supply of the demonstration group exceeded the quantity which is ordinarily regarded as an adequate allowance for children (15, 20). The entire control group was receiving very much less than the recommended allowance and the cases were concentrated at the lowest values of the range for calcium. The analysis indicated that the dry skim milk supplements had radically altered the milk consumption habits of the demonstration children and that the milk consumption of the control children had proceeded at the customary low level of that group.

The frequency of use of fruits and vegetables described by the mean and standard deviation was 14.9 ± 7.1 servings per week for the demonstration group and 13.3 ± 8.1 servings per week for the control group. The differences between the means and between the variances of the two groups were not significant. The differences can be explained by sampling from a homogeneous population and they probably do not represent a difference between the demonstration and control groups with respect to frequency of use of fruits and vegetables. The same interpretation applies to the differences between the demonstration and control groups in their frequency of use of potatoes, bread and cereals, desserts and sweets. The means and standard deviations for the two groups for servings per week in the 3 food classes just mentioned were: 5.9 ± 3.1, 6.0 ± 3.4; 34.7 ± 10.7, 35.8 ± 12.0; 12.7 ± 6.4, 12.8 ± 6.0.

TABLE 7

A COMPARISON OF THE DIETS OF THE DEMONSTRATION AND CONTROL GROUPS WITH RESPECT TO CALCIUM FROM MILK SOURCES AND SERVINGS PER WEEK OF SPECIFIED CLASSES OF FOODS CALCULATED FROM THE MEASURED DIET RECORDS

Item	Cases		Calcium from milk sources	Fruits and vegetables	Legumes and nuts	Meat, fish and poultry	Butter and cod liver oil	Potatoes	Eggs	Bread and cereals	Desserts and sweets
	Records	Children									
	Number	number	Grams per day per child	Servings per week per child	Servings per week per child	Servings per week per child	Servings per week per child	Servings per week per child	Servings per week per child	Servings per week per child	Servings per week per child
Median											
Demonstration group	207	101	1.67	13.3	2.6	6.1	4.2	5.4	2.5	33.0	11.7
Control group	217	112	.19	11.8	3.1	7.3	4.6	5.4	2.2	33.8	12.5
First quartile											
Demonstration group	207	101	1.14	9.7	1.2	4.3	1.5	3.6	1.6	26.6	8.0
Control group	217	112	.09	7.8	1.8	5.3	1.9	3.5	1.3	27.4	8.1
Third quartile											
Demonstration group	207	101	2.09	18.0	4.7	7.9	7.2	7.6	4.1	41.7	17.1
Control group	217	112	.28	16.8	4.8	10.0	7.8	8.1	3.7	43.5	15.5
Mean											
Demonstration group	207	101	1.68	14.9	3.2	6.0	5.4	5.9	3.0	34.7	12.7
Control group	217	112	.21	13.3	3.9	7.6	5.8	6.0	2.7	35.8	12.8
"Student's" t	---	---	--- 1/	1.593	--- 1/	4.139 1/	--- 1/	.776	--- 1/	.744	.094
Standard deviation											
Demonstration group	207	101	.70	7.1	2.5	2.6	4.0	3.1	2.0	10.7	6.4
Control group	217	112	.15	8.1	3.1	3.2	5.2	3.4	2.0	12.0	6.0
Snedecor's F	---	---	--- 1/	1.295	--- 1/	1.496 2/	--- 1/	1.185	--- 1/	1.296	1.126

1/ Difference between the means is significant.
2/ Difference between the variances is significant.
3/ Quantity not calculated.

The control group received more frequent servings of meat, fish and poultry. This finding is consistent with the very large increase in milk consumption of the demonstration group. The field workers instructed the homemakers in the use of recipes calling for dry skim milk. These were primarily recipes for meat-free-dishes. The servings per week of meat, fish and poultry for the control group were 7.6 $\pm$ 3.2 and for the demonstration group 6.0 $\pm$ 2.6.

The diets of the demonstration and control groups were similar with respect to the use of legumes and nuts, butter and cod liver oil and eggs. The distributions for the food classes departed widely from the normal and the criteria of significance could not be applied. The weekly servings of legumes and nuts were 3.2 $\pm$ 2.5 and 3.9 $\pm$ 3.1 for the demonstration and control groups respectively. The weekly servings of butter and cod liver oil for the two groups were 5.4 $\pm$ 5.0 per week and 5.8 $\pm$ 5.2 per week. The corresponding values for eggs were 3.0 $\pm$ 2.0 servings per week and 2.7 $\pm$ 2.0 servings per week.

The measured-diet records indicated clearly that the demonstration and control groups shared a common frequency pattern of food usage for all food classes considered, except milk, and meat, fish and poultry. The difference in the latter respect, while statistically significant, is probably minor from a nutritional standpoint, in view of the large increase in milk consumption of the demonstration group.

In Figure 2, histograms of the frequency distributions for calcium and the food classes have been arranged to illustrate the extent of overlapping of demonstration and control groups. The histograms for calcium show almost no overlapping. Those for the food classes show a close correspondence between demonstration and control groups, both in form and in position, with reference to the number of weekly servings. The area occupied by the middle 50 per cent of the cases has been shaded. Position of the median is indicated by an arrow, directed toward the scale of servings.

Frequency patterns of food usage, illustrated in Figure 2, may be roughly evaluated for adequacy of the diet by reference to the frequency pattern of servings, described in the plan for a minimum cost adequate diet (4). Correspondence between the servings, as defined in this study and those of the diet plan referred to, is not exact but the discrepancy in definitions of servings is not so great as to vitiate certain general evaluations. "The plan for a minimum-cost, adequate diet gives the cheapest combination of foods that it is desirable to use for an indefinite period. In order to meet all nutritional needs as cheaply as possible, this diet has a large quantity of cereal products and milk as its basis. Just enough of vegetables, fruits, eggs, and lean meats are used to supply vitamins, minerals, and protein, not adequately furnished by bread and milk, and enough of fats and sweets are included to round out the calories." (4, p.10).

The plan for a minimum cost adequate diet calls for approximately 14 to 17 servings a week of fruits and vegetables, as grouped in this study. Forty-eight per cent of the demonstration children and 58 per cent of the control children were receiving fewer than 14 servings a week of fruits and vegetables. The recommended frequency of servings for eggs is 4 to 5 a week. Seventy-three per cent of the demonstration children and 77 per cent of the control children were receiving less than 4 a week. All control children were receiving less milk than the recommended 1 quart daily of the diet plan. Meat, fish and poultry and probably bread and cereals occupied a more important position in the diets of the children studied than is considered desirable in view of gross deficiencies in other essential foods.

Some evidence of the reliability of the measured-diet records, as a description of the actual dietary habits of the children, was obtained by comparing the measured-diet and the converted-quantitative-diet records of the 17 children for

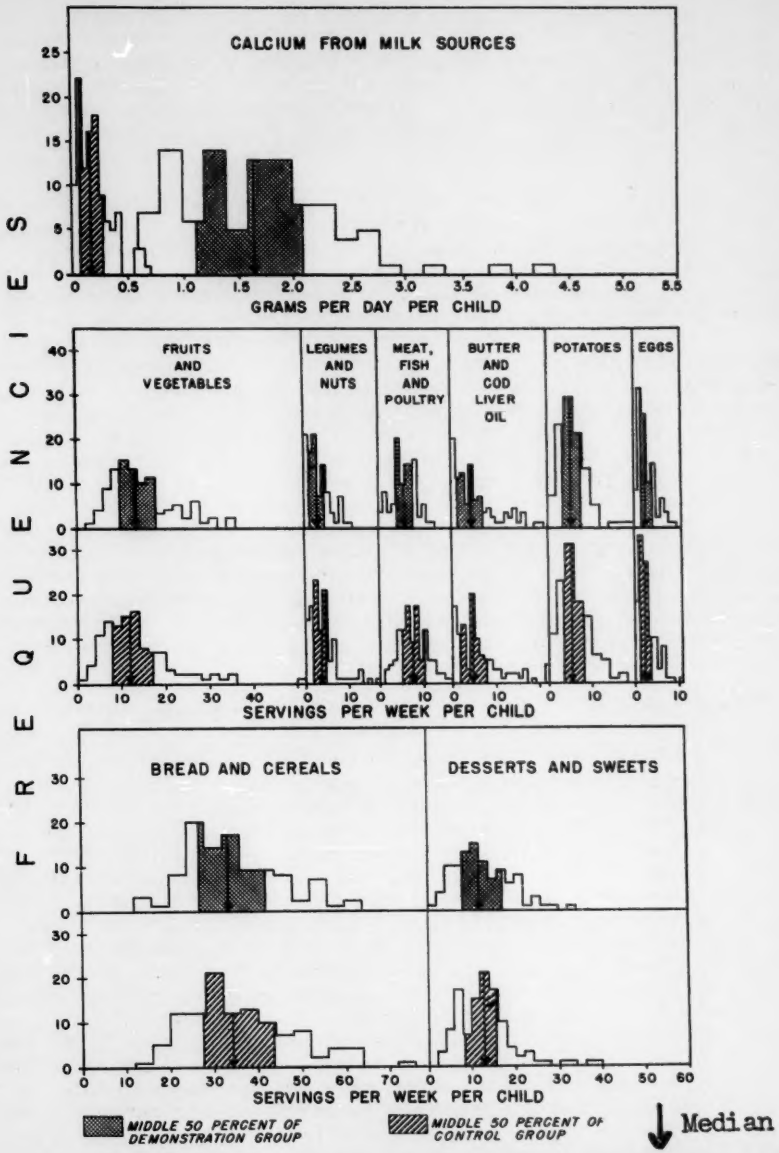

Fig. 2. A comparison of the diets of the demonstration group with those of the control group with respect to calcium from milk sources and servings per week of specified classes of foods calculated from the measured diet records.

whom quantitative-diet records were obtained. The converted-quantitative-diet records were taken simultaneously with the quantitative-diet records. They were the volumes, measured by cup, tablespoon or teaspoon, of the foods weighed and eaten during the record week. Measures were converted into servings. Converted-quantitative-diet records were prepared by the homemaker under the daily supervision of the field agent. Measured-diet records for the same children were prepared by the homemaker much earlier in the study period and with less supervision.

Measured-diet records of 17 children and converted-quantitative-diet records of the same children are arranged for comparison in Table 8. There is close correspondence between the two types of records. For fruits and vegetables; meat, fish and poultry; potatoes; bread and cereals; desserts and sweets, which appeared from the measured-diet records to be normally distributed, an analysis of variance was made which indicated that the differences between the means of the two types of records were not significant. A correlation by rank of the servings reported on the measured-diet records and the converted-quantitatives, was also tried for the same food classes to test the consistency of the reports for individual children. Rank correlations between the 2 types of records of .82, .77, .75, .69, .46 and .33 were obtained in this order for bread and cereals; meat, fish and poultry (control cases); meat, fish and poultry (demonstration cases); fruits and vegetables; potatoes; desserts and sweets. While no significance can be attached to the two smallest rank correlations the others are larger than can be accounted for by chance alone. The corresponding coefficients of correlation and measures of reliability are shown in Table 16 in the appendix. The similarity of the means of the two types of records in several of the food classes and the evidence of individual consistency in three of the food classes indicated that the measured-diet records prepared by the homemaker can probably be regarded as a reliable description of the aspects of the diets which the measured-diet records considered.

NUTRITIVE VALUE OF THE DIETS OF THE DEMONSTRATION AND CONTROL GROUPS

The quantitative-diet records obtained for 11 of the demonstration children and 6 of the control children provided a basis for considering the nutritive value of the diets of the demonstration and control groups.

Although the number of children for whom quantitative-diet records were obtained was small, the children were, in many respects, representative of the groups from which they were chosen. The extent to which they were representative was determined by the position of these children in the distributions based on the measured-diet records. In Tables 5 and 6, for each food class and for calcium, the intervals are indicated in which occur the measured-diet records of these 17 children. This tabulation is shown graphically in Figure 3. The sub-sample of children was fairly central in the demonstration and control distributions with respect to legumes and nuts; meat, fish and poultry; butter and cod-liver oil; potatoes; eggs; bread and cereals; desserts and sweets. In the distributions for fruits and vegetables the demonstration cases occurred more frequently above, while those of the control group were more frequently below the median. The sub-samples of demonstration and control children were more divergent with respect to use of fruits and vegetables than were the two groups as a whole. The demonstration and control sub-samples were both somewhat below the medians of their respective groups in the calcium distributions. While their positions with respect to each other were similar to that of the demonstration and control groups as a whole, the sub-samples underestimated somewhat the typical milk consumption of the larger groups from which they were drawn.

TABLE 8

CALCIUM FROM MILK SOURCES AND SERVINGS PER WEEK OF SPECIFIED CLASSES OF FOODS CALCULATED FROM THE MEASURED DIET RECORDS AND ALSO FROM THE CONVERTED QUANTITATIVE DIET RECORDS OF 11 DEMONSTRATION CASES AND 6 CONTROL CASES

Group and case number	Calcium from milk sources		SERVINGS PER WEEK: Fruits and vegetables		Legumes and nuts		Meat, fish and poultry		Butter and cod liver oil		Potatoes		Eggs		Bread and cereal		Desserts and sweets	
	Measured diet records	Converted diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records	Measured diet records	Converted quantitative diet records
Demonstration cases	Grams per day	Grams per day	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number	Number
168E	1.32	0.94	14.0	12.9	0.0	0.0	4.0	3.5	11.8	10.0	5.8	4.0	2.2	2.5	25.0	24.6	16.9	6.0
76E	1.22	1.64	21.1	29.9	1.0	1.0	4.5	3.0	19.9	16.8	8.0	7.0	1.3	2.0	34.3	33.0	9.5	2.0
46E	1.54	1.38	12.3	2.0	6.7	3.2	5.8	8.0	3.7	2.0	6.3	7.0	2.0	0.0	55.9	38.8	8.3	0.0
39E	0.89	0.54	5.1	6.5	3.8	5.0	6.7	7.5	1.8	5.3	2.3	0.8	2.6	8.0	36.0	38.2	11.0	14.5
169E	1.30	0.93	13.8	9.8	0.0	0.0	5.0	3.4	9.2	4.5	6.2	4.5	2.2	2.8	30.2	24.7	21.2	6.0
34E	1.37	1.50	17.0	21.5	2.3	3.0	8.5	8.0	0.0	0.0	3.7	1.8	1.8	0.0	37.5	34.8	15.5	21.5
87E	0.85	0.73	22.3	21.5	2.0	0.0	6.7	5.5	7.0	11.0	5.0	3.5	2.0	0.0	31.2	46.1	15.7	12.5
113E	1.60	1.11	12.8	5.5	1.0	3.0	6.2	7.0	1.0	0.0	3.9	4.2	1.0	1.0	27.9	23.2	1.5	0.0
237E	0.71	0.47	12.6	15.0	2.0	4.0	1.2	0.5	14.0	32.0	5.0	3.0	0.0	0.0	54.5	55.0	9.7	10.0
29E	0.94	0.79	17.0	16.9	0.0	0.0	5.8	7.3	0.0	0.0	2.1	2.2	0.0	0.0	29.7	24.1	23.8	20.5
205E	1.76	1.23	19.4	21.9	0.3	1.0	9.3	7.6	5.0	0.0	8.8	5.0	2.9	3.0	25.3	31.5	18.1	10.2
Mean	1.2	1.0	15.2	14.9	1.7	1.8	5.8	5.6	6.7	7.4	5.2	4.0	1.6	1.8	35.2	34.0	13.7	9.4
Median	1.30	0.94	14.0	15.0	1.0	1.0	5.8	7.0	5.0	4.5	5.0	4.0	2.0	1.0	31.2	33.0	15.5	10.0
Standard deviation	.34	.38	4.9	8.5	2.0	1.8	2.2	2.4	6.5	9.9	2.1	2.0	1.0	2.4	10.7	10.1	3.3	7.5
Range	0.71-	0.47-	5.1-	2.0-	0.0-	0.0-	1.2-	0.5-	0.0-	0.0-	2.1-	0.8-	0.0-	0.0-	25.0-	23.2-	1.5-	0.0-
	1.76	1.64	22.3	29.9	6.7	5.0	9.3	8.0	19.9	32.0	8.8	7.0	2.9	8.0	55.9	55.0	23.8	21.5
Control Cases																		
215	0.07	0.03	11.2	10.0	2.0	4.0	6.8	9.8	4.0	0.0	5.5	2.0	1.5	0.0	18.5	19.5	12.5	8.0
9	0.35	0.36	9.8	7.3	5.0	8.0	7.2	7.0	7.2	11.5	3.8	3.5	3.3	3.0	31.8	32.5	11.5	12.0
108	0.06	0.08	11.3	9.7	4.2	8.5	3.2	5.0	7.0	7.0	3.0	5.0	4.0	6.0	21.4	28.3	13.0	9.5
X 108	0.04	0.03	17.9	7.8	3.2	6.3	2.8	4.5	8.0	10.0	3.3	5.1	2.5	5.0	26.0	34.5	12.0	13.3
213	0.19	0.20	6.0	9.8	4.0	4.0	3.2	3.8	0.5	0.0	4.2	3.0	0.5	1.0	21.3	23.4	14.8	11.0
248	0.05	0.00	8.6	5.3	2.0	4.0	3.8	5.0	10.2	11.0	7.2	4.0	4.0	0.6	43.2	50.5	9.0	12.5
Mean	0.13	0.12	10.8	8.3	3.4	5.8	4.5	5.9	6.2	6.6	4.5	3.8	2.6	2.6	27.0	31.5	12.1	11.1
Median	0.06	0.05	10.5	8.8	3.6	5.2	3.5	5.0	7.1	8.5	4.0	3.7	2.9	2.0	23.7	30.4	12.2	11.5
Standard deviation	0.12	0.14	4.0	1.9	1.2	2.1	2.0	2.2	3.4	5.3	1.6	1.2	1.4	2.5	9.2	10.9	1.9	2.0
Range	0.04-	0.00-	6.0-	5.3-	2.0-	4.0-	2.8-	3.8-	0.5-	0.0-	3.0-	2.0-	0.5-	0.0-	18.5-	19.5-	9.0-	8.0-
	0.35	0.36	17.9	10.0	5.0	8.5	7.2	9.8	10.2	11.5	7.2	5.1	4.0	6.0	43.2	50.5	14.8	13.3
Demonstration and control cases combined																		
Mean	--- 1/	--- 1/	13.7	12.6	--- 1/	--- 1/	--- 1/	--- 1/	--- 1/	--- 1/	5.0	3.9	--- 1/	--- 1/	32.3	33.1	13.2	10.0
Standard deviation	---	--- 1/	4.9	7.5	--- 1/	--- 1/	--- 1/	--- 1/	--- 1/	--- 1/	1.9	1.7	--- 1/	--- 1/	10.7	10.1	3.0	6.1

1/ Quantity not calculated.

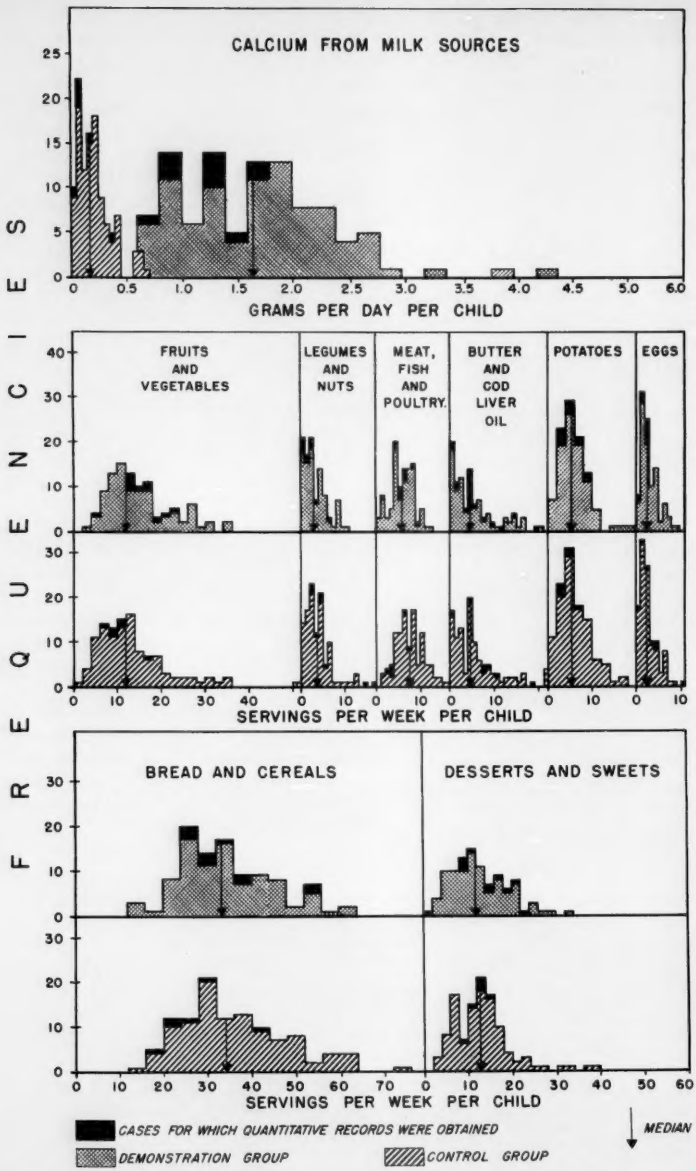

Fig. 3. Relative position, in the total distributions for calcium from milk sources and servings per week of specified classes of foods, of the 11 demonstration cases and 6 control cases for which quantitative records were obtained.

With the reservations mentioned the quantitative-diet records may be regarded as representative of the diets of the demonstration and control groups.

Table 9 shows the daily nutritive value of the diets calculated from the quantitative-diet records of the 11 demonstration and 6 control children. The cases in each group are arrayed for milk supply. It is expressed as the quantity of fluid skim milk to which the various forms of milk used were equivalent in calcium content. Daily milk supply of the control group ranged from none to quantities equivalent to 360 grams of fluid skim milk. The median supply of milk was equivalent to 90 grams of fluid skim milk. An allowance of approximately 1.0 grams of calcium daily, the quantity recommended for children of preschool age, (15, 20) is provided by the equivalent of 833 grams of fluid skim milk daily. The median for the demonstration cases, 820 grams of fluid skim milk a day, approximated this milk allowance. Without the contribution of dry skim milk the milk supply of the control and demonstration cases would have been closely comparable. The role of dry skim milk in supplementing the diets of the demonstration cases is shown clearly in Figure 4, the top section illustrating the milk supply equivalent to quantities of fluid skim milk indicated. The relative position of each case with respect to milk supply is maintained throughout the other sections of Figure 4, which represent quantities of nutrients provided by the diets as described in the quantitative-diet records and summarized in Table 9. Individual diets can be considered readily when case position is kept in mind.

Diets of the control cases exhibited inadequacies frequently associated with restricted milk supply. The calcium intakes ranged from 10 to 48 milligrams per kilogram of body weight. Range of phosphorus intakes was 29 to 68 milligrams per kilogram. Medians for calcium and phosphorus were 15.5 and 38.5 milligrams per kilogram respectively. For preschool children, allowances of 45 to 50 milligrams of calcium per kilogram and 60 to 70 milligrams of phosphorus per kilogram have been recommended (8). Only one control case fell within the recommended ranges.

The range of protein content for control cases was 26 to 47 grams. The median was 36 grams. A protein content of 49 to 56 grams has been suggested as desirable for this age group (23). All control cases were receiving smaller amounts of protein than this allowance. Daniels and others (7) have proposed 3.2 grams of protein per kilogram of body weight to meet the needs of preschool children. The diets of the control cases with one exception provided less protein than this allowance.

The energy value of the diets of the control cases ranged from 910 to 1390 calories. The median was 1100 calories. From the averages reported in several studies it has been estimated that the energy-giving foods consumed by children comparable in age to those of this study afforded daily from 1400 to 1575 calories (12). The energy value of all of the control diets fell below the lower limit of that range. The energy value of the diets of the 3-year-old cases was less than that found by Rose and others (19) for a 3-year-old group of well nourished boys and girls. The median value for the latter group was 1350 calories. For 3-year-old boys and girls, Bray, Hawks and Dye (3) have reported an average of 1260 calories, and for 4-year-old boys and girls, 1440 calories.

The iron intakes of the control children ranged from .27 to .55 milligrams per kilogram. The median value was .47 milligrams per kilogram. Very little direct information is available on the iron requirements of preschool boys. An allowance of 5 to 6 milligrams per kilogram has been estimated to permit generous retention (14, 1). Half the control cases fell below and half within this range. The iron content of the diets of approximately half the demonstration cases was less than the proposed allowance. Iron provided by the dry skim milk supplements was negligible.

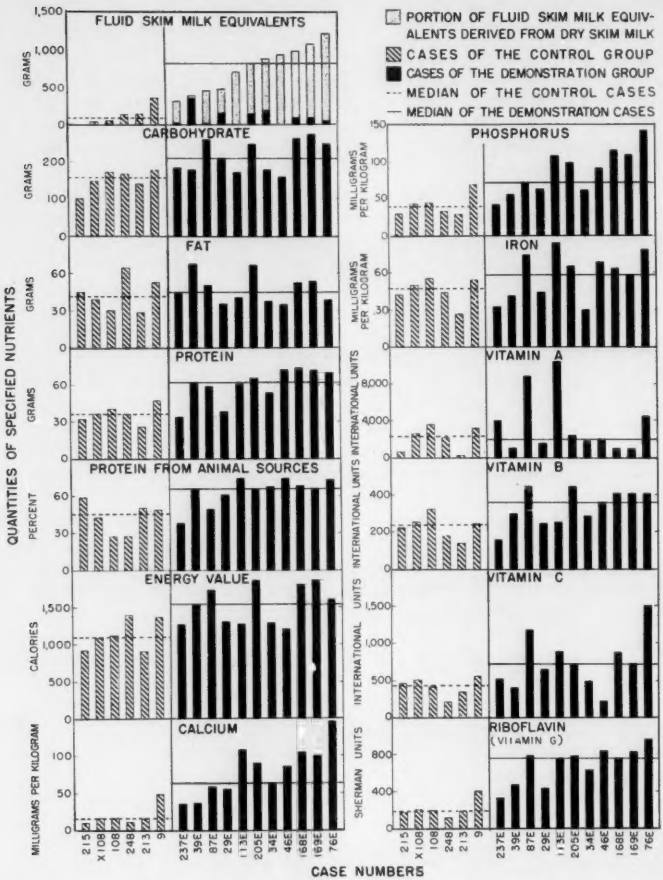

Fig. 4. Nutritive value per day of the diets of 11 demonstration cases and 6 control cases arrayed with respect to milk consumption per day.

The median for vitamin A content of the control diets was 2400 International Units. The values reported for all control cases and all except two demonstration cases were considerably less than a recently recommended allowance, (6,000 to 8,000 International Units) (2). Tested by smaller allowances, which have been recommended earlier, more than half the cases in the two groups would still be considered below the level of adequacy (6, 11, 16). The apparently greater vitamin A content of the demonstration diets is due to sampling rather than the dry skim milk supplements. Dry skim milk is a very poor source of this vitamin.

The range for vitamin B provided by the diets of the control cases was 140 to 330 International Units. The median was 240 International Units. Knott (13) has suggested 20 International Units per kilogram of body weight as an allowance which will provide optimum retention for children. The diets of all control cases fell short of this allowance.

TABLE 9

NUTRITIVE VALUE PER DAY OF THE DIETS OF THE DEMONSTRATION AND CONTROL CASES FOR WHICH QUANTITATIVE DIET RECORDS WERE OBTAINED

Group and case number	Age 1/	Weight 1/	Fluid skim milk equivalents per day derived from: 2/		Carbohydrate	Fat	Protein	Protein from animal sources	Energy value	Calcium		Phosphorus		Iron		Vitamins			
			All sources	Dry skim milk												A	B	C	Riboflavin (vitamin G)
Demonstration cases	Months	Kilograms	Grams	Grams	Grams	Grams	Grams	Per cent	Calories	Grams	Milligrams per kilogram	Grams	Milligrams per kilogram	Milligrams	Milligrams per kilogram	International units	International units	International units	Sherman units
237 E	53	15.6	310	295	182	44	34	38	1,260	0.56	36	0.66	42	5.06	.32	4,000	160	520	310
79 E	51	19.0	390	30	176	67	62	65	1,540	0.71	37	1.07	56	7.82	.41	1,100	300	410	490
87 E	49	16.6	450	447	258	50	59	49	1,730	0.97	58	1.20	72	12.23	.74	9,000	450	1,180	790
29 E	49	13.2	480	325	208	34	38	61	1,300	0.74	56	0.83	63	5.84	.44	1,600	250	650	440
113 E	43	11.8	710	712	171	40	61	74	1,270	1.23	104	1.28	108	9.98	.84	10,500	260	890	750
205 E	49	14.5	820	681	245	66	65	65	1,860	1.30	90	1.44	99	9.43	.65	2,400	450	720	770
34 E	45	19.7	880	702	179	37	54	67	1,280	1.26	64	1.21	61	5.99	.30	1,800	290	490	630
46 E	48	15.6	940	936	158	34	70	74	1,220	1.34	85	1.44	92	10.59	.68	2,000	360	220	840
168 E	35	13.6	990	915	263	52	74	68	1,800	1.43	105	1.57	116	8.58	.63	1,000	410	850	770
169 E	52	15.4	1,070	997	272	53	72	65	1,860	1.56	101	1.68	109	8.90	.58	1,000	410	730	830
76 E	34	12.2	1,220	1,180	249	38	70	73	1,600	1.79	146	1.74	142	9.59	.78	4,500	410	1,510	960
Median	49	15.4	820	702	208	44	62	65	1,540	1.30	64	1.28	72	8.90	.58	2,000	360	720	770
Range	34-53	11.8-19.7	310-1,220	30-1,180	158-272	34-67	34-74	38-74	1,220-1,860	0.56-1.79	36-146	0.66-1.74	42-142	5.06-12.23	.30-.78	1,000-10,500	160-450	220-1,510	310-960
Control cases																			
215	36	15.4	0	---	100	44	32	59	920	0.15	10	0.46	30	6.52	.42	700	230	460	180
X 108	48	14.5	30	---	146	38	36	42	1,080	0.23	16	0.62	43	7.24	.50	2,600	260	500	210
108	38	17.9	50	---	169	30	40	28	1,110	0.29	16	0.79	44	9.93	.55	3,600	330	410	200
248	48	16.8	130	---	166	64	36	28	1,390	0.20	12	0.57	34	7.33	.44	2,200	190	200	120
213	49	15.9	140	---	138	28	26	50	910	0.24	15	0.46	29	4.35	.27	300	140	340	190
9	30	11.8	360	---	177	52	47	49	1,360	0.57	48	0.80	68	6.36	.54	3,100	250	560	410
Median	43	15.6	90	---	156	41	36	46	1,100	0.24	15.5	.593	38.5	6.88	.47	2,400	240	440	200
Range	30-49	11.8-17.9	0-360	---	100-177	28-64	26-47	28-59	910-1,390	0.15-0.57	10-48	0.46-0.80	29-68	4.35-9.93	.27-55	300-3,600	140-330	220-560	120-410

1/ At time of the first examination.

2/ The calcium content of 10 grams of fluid skim milk is 0.012 grams. The following are equivalent to 10 grams of fluid skim milk in calcium content: 10 grams of whole milk, 10 grams of buttermilk, 4.6 grams of evaporated milk, 1.3 grams of American cheese, and .9 grams of dry skim milk.

The vitamin C content of the diets was unaffected by the supplements. Demonstration cases showed a wider range and larger median than the control, probably as a result of the sampling. Median values were 720 International Units for demonstration cases and 440 International Units for control cases. Only a beginning has been made in the determination of the requirement for vitamin C and evidence not now available is needed to appraise satisfactorily the vitamin C content of the diets. The provision of 700 International Units per day adopts a middle course with respect to much smaller and larger allowances which have been proposed (18, 9). All control and approximately half the demonstration cases were provided with less than 700 International Units per day. It is likely that the vitamin C content of the diets is overestimated since no allowance has been made for the destruction of vitamin C in food preparation.

The riboflavin (vitamin G) requirement for preschool boys has not yet been determined. Sherman and Lanford (21) have recently suggested 450 Sherman Units daily for boys under 6 years. All of the control cases were provided with less than this amount. The range of riboflavin for the control cases was 120 to 410 Sherman Units. The median was 200 Sherman Units. The demonstration cases were receiving from 310 to 960 Sherman Units of riboflavin. The median for this group was 770 Sherman Units.

Tested by the dietary standards available at present for the age groups in this study, the unsupplemented diets of the control cases were found to provide in most cases inadequate quantities of calories, good quality protein, calcium, phosphorus, vitamins A, B, C and riboflavin (vitamin G). Half the control cases were receiving less than the recommended iron allowance.

When dry skim milk supplements were sufficient to augment the daily milk supply of the demonstration cases to an amount equivalent to 820 grams or more of fluid skim milk, the diets of the demonstration cases did not exhibit the typical dietary inadequacies of the control cases. The problem of balancing these low-cost, low milk consumption diets was simplified to providing larger quantities of iron, vitamin A and vitamin C.

PHYSICAL FINDINGS

The demonstration group for which measured-diet records were obtained consisted of 101 children. Measured-diet records were secured for 112 control children. An initial physical examination was completed for each of these children except as noted in Tables 13 and 14 in the appendix. At the close of the study 98 demonstration children and 108 control children returned for re-examination. Change of residence, illness, or unwillingness of the child to return to the laboratory accounted for the loss of 3 demonstration cases and 4 control cases for whom measured-diet records were available. In the group of 98 demonstration children there were 39 3-year-old and 59 4-year-old boys. The control group was composed to 49 3-year-old and 59 4-year-old boys.

The average span of observation was approximately 125 days. Large differences in physical status between the demonstration and control groups were not to be expected by the end of so brief a period. While the modifications of the diets of the demonstration children were profound, they were such as are known to promote, in animal experimentation, general well-being and to accelerate growth in body dimensions and bulk. The cumulative effect of accelerated growth is obvious after an extended period, but it is difficult to measure after a short period. Of the body measurements recorded, stature showed a progressive increment, measurable within the errors of observation.

Within the period of the study a measurable difference with statistical validity could not be found for spread of ossification as evidenced by the

maximum transverse diameter of the radial epiphysis.

Hemoglobin, erythrocytes, serum calcium and phosphorus showed no significant changes in means and variances during the study period. They will be discussed in a later paper from the point of view of the significance of age, seasonal and group differences.

The frequency distribution for stature and weight at the time of the first and second physical examinations and for transverse breadth of chest and cristal breadth at the time of the first physical examination are shown in Tables 12, 13, and 14 in the appendix.

Growth in stature during the study has been considered in terms of individual increments of stature rather than with reference to the differences between group averages at the opening and close of the study. Table 10 shows the frequency distributions for increments of stature of the demonstration and control groups. In the 3-year-old series the mean and standard deviation of the increment were found to be 34.3 $\pm$ 6.8 millimeters for the demonstration group and 33.7 $\pm$ 8.3 millimeters for the control group. Corresponding values in the 4-year-old series were 34.0 $\pm$ 7.3 and 31.0 $\pm$ 9.0. Increments of stature appeared to be normally distributed and the differences between the means and between the variances of the two groups were tested for significance by "Student's" t and Snedecor's F. Results are summarized in Table 11. Differences between the means and between the variances of demonstration and control groups were found to be significant for the 4-year-old series. The average increment of the 4-year-old demonstration group was larger than that of the corresponding control group. The variance of the increments in the 4-year-old demonstration group was smaller than that of the control group. These differences in the distributions of increments for the two groups at the 4-year-old level indicated a greater and more homogeneous growth in stature for the children who received the dry skim milk supplements. It is of interest that the differences in the same direction were found between the means and between the variances of the increments for the 3-year-old demonstration and control groups, although statistical significance was not established for these differences. The value of F, 1.49, for the 3-year-

TABLE 10

FREQUENCY DISTRIBUTIONS FOR INCREMENTS OF STATURE FOR THE 3- AND 4-YEAR-OLD SERIES OF THE DEMONSTRATION AND CONTROL GROUPS

Class intervals of stature increments	3-year-old series		4-year-old series	
	Demonstration group	Control group	Demonstration group	Control group
Millimeters	Frequency	Frequency	Frequency	Frequency
10 - 15	0	0	0	2
15 - 20	0	2	1	3
20 - 25	3	5	4	11
25 - 30	7	9	13	13
30 - 35	12	12	17	11
35 - 40	11	11	13	10
40 - 45	4	6	7	4
45 - 50	1	3	2	4
50 - 55	1	0	2	1
55 - 60	0	1	0	0
Total	39	49	59	59
Mean	34.3	33.7	34.0	31.0
Standard deviation	6.8	8.3	7.3	9.0

TABLE 11

EVALUATION OF THE DIFFERENCES IN INCREMENTS OF STATURE OF THE DEMONSTRATION AND CONTROL GROUPS FOR EACH AGE SERIES

Series	Increments of stature								Criteria of significance	
	Demonstration group				Control group				Difference in variances	Difference in means
	Cases	Mean	Standard deviation	Variance	Cases	Mean	Standard deviation	Variance	Snedecor's F	"Student's" t
	Number	Millimeters	Millimeters	Millimeters	Number	Millimeters	Millimeters	Millimeters		
3-year-old series	39	34.30	6.75	45.56	49	33.70	8.25	68.06	1.49	.367
4-year-old series	59	33.95	7.30	53.29	59	30.95	9.00	92.16	1.52 1/	1.986 2/

1/ Difference between the variances is significant.
2/ Difference between the means is significant.

old variances would be significant if the cases in this series were as numerous as those of the 4-year-old series. Roberts (16) has reported recently an average difference for 1 year of growth of 0.9 centimeters between the stature increments of children whose milk consumption was increased and a companion group whose diets were unsupplemented.

SUMMARY

This study was undertaken to appraise more fully the dietary effects of dry skim milk supplements in low-cost diets deficient in milk products. As the period was brief, 141 days, the measurement of nutritional effects was limited to consideration of increments of stature.

The sample consisted of 213 preschool Negro boys living in the District of Columbia, whose daily estimated milk consumption did not exceed approximately a cup of fluid milk or its equivalent in milk products. The sample was divided on a geographical basis into a control group of 101 children and a demonstration group of 112 children. The children lived at home and none attended nursery school. The demonstration and control groups were comparable from the standpoint of body measurements and age in months. Illness histories and illnesses during the study period were similar for the two groups. The weekly income of the demonstration families was $16.45 ± $7.20, that of the control families was $17.78 ± $7.40. The families of the control group were slightly larger in size than those of the demonstration group and occupied slightly larger dwellings. Both groups of families were living under very crowded conditions.

The families of the demonstration children received throughout the period of the study regular supplements of dry skim milk which, with the customary supply of milk products, provided adequate milk-solids other than fat for all young members of the family and almost all of the adults. The family milk-consumption records indicated that the supplements of dry skim milk were regular and adequate and were freely used in the demonstration homes.

The children were given physical examinations at the opening and at close of the study. Measured-diet records were obtained for all of the children. Quantitative-diet records were kept for a sample of the demonstration children and similarly for the control children.

The measured-diet records provided a description of the frequency patterns of food usage of the demonstration and control groups. The classes of foods considered were milk in various forms; fruit and vegetables, exclusive of potatoes; legumes and nuts; meat, fish and poultry; butter and cod liver oil; potatoes; eggs; bread and cereal; desserts and sweets. For the demonstration group the mean and standard deviation for calcium supply from milk were 1.68 ± .70

grams per day per child. The corresponding values were .21 ± .15 grams per day per child for the control group. The frequency of use of all classes of foods except milk was closely similar for the demonstration and control groups with the exception of meat, fish and poultry which were served somewhat less frequently to the demonstration children. A comparison of the measured-diet records of 17 children with similar records prepared under close supervision for the same children indicated that the measured-diet records probably gave accurate descriptions of the frequency with which various foods were served to the children studied.

The daily nutritive value of the diets of the demonstration and control children was estimated by means of quantitative-diet records, obtained for a sample of 11 demonstration and 6 control children. The milk supply of the 6 control cases ranged from none to an amount equivalent to 360 grams of fluid skim milk per day. The median amount was equivalent to 90 grams of fluid skim milk. The median for the milk supply of the 11 demonstration cases was equivalent to 820 grams of fluid skim milk. The range for these cases was from an amount of milk, equivalent to 310 grams of fluid skim milk, to an amount equivalent to 1220 grams. The calcium supply of the diets ranged from 10 to 48 milligrams per kilogram for the control cases and from 36 to 146 milligrams per kilogram for the demonstration cases. The median for the control cases was 15.5 milligrams per kilogram and for the demonstration cases 64 milligrams per kilogram.

The range for intake of phosphorus per kilogram of body weight was 29 to 68 milligrams for the control cases and 42 to 142 milligrams for the demonstration cases. The respective medians were 38.5 milligrams per kilogram and 72 milligrams per kilogram.

The protein content of the diets of the control cases ranged from 26 to 47 grams. The median was 36 grams. The corresponding range for the demonstration cases was 34 to 74 grams with the median at 62 grams.

The control diets provided 910 to 1390 calories. The median value was 1,100 calories. The range of energy value for the demonstration cases was 1,220 to 1,860 calories with the median at 1,540 calories.

The iron content of the demonstration and control diets was similar. Dry skim milk provides negligible amounts of iron. The range of iron intake of the control cases was .27 to .55 milligrams per kilogram of body weight with the median at .47 milligrams per kilogram. The corresponding demonstration range was .30 to .78 milligrams per kilogram. The median for the demonstration cases was .58 milligrams per kilogram. The somewhat larger values of the demonstration cases arise from errors of sampling.

The vitamin A provided by the control diets ranged from 300 International Units to 3,600 International Units. The demonstration diets had a wider range for vitamin A content, 1,000 International Units to 10,500 International Units, due to sampling rather than to the dry skim milk supplements. Dry skim milk is a very poor source of vitamin A.

The range of vitamin B content for the control diets was 140 to 330 International Units. For the demonstration diets the range was 160 to 450 International Units. The corresponding medians were 240 International Units and 360 International Units.

The riboflavin (vitamin G) provided by the control diets was 120 to 410 Sherman Units. The demonstration diets provided 310 to 960 Sherman Units of riboflavin. The median value was 770 Sherman Units for the diets of the demonstration cases.

When the dry skim milk supplements were sufficient to increase the milk supply of the demonstration cases to the equivalent of 820 grams or more of fluid skim milk, the demonstration cases did not exhibit the dietary inadequacies

typical of the control cases with respect to good quality protein, energy value, vitamin B, riboflavin (vitamin G), calcium and phosphorus.

Growth in stature during a period of approximately 4 months was more homogeneous and somewhat greater for the 4-year-old demonstration group than for the corresponding series of the control group.

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APPENDIX

TABLE 12

FREQUENCY DISTRIBUTIONS FOR STATURE AT FIRST AND SECOND PHYSICAL EXAMINATIONS OF THE CHILDREN OF THE DEMONSTRATION AND CONTROL GROUPS

Class intervals of stature	3-year-old series				4-year-old series			
	First Examination		Second Examination		First Examination		Second Examination	
	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group
Centimeters	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency
78.0 - < 79.0	--	--	--	--	1	--	--	--
79.0 - < 80.0	--	--	--	--	0	1	--	--
80.0 - < 81.0	1	--	--	--	0	0	--	--
81.0 - < 82.0	0	--	--	--	0	0	--	--
82.0 - < 83.0	0	4	--	--	0	0	--	--
83.0 - < 84.0	0	0	--	--	0	0	1	--
84.0 - < 85.0	0	1	1	1	0	1	0	1
85.0 - < 86.0	3	2	0	0	0	0	0	0
86.0 - < 87.0	0	0	0	2	0	0	0	0
87.0 - < 88.0	3	1	0	1	0	1	0	0
88.0 - < 89.0	4	1	0	1	2	0	0	1
89.0 - < 90.0	2	6	3	2	0	0	0	1
90.0 - < 91.0	2	3	2	1	0	3	0	0
91.0 - < 92.0	3	7	3	4	0	2	0	0
92.0 - < 93.0	3	5	2	2	3	1	2	1
93.0 - < 94.0	5	6	3	6	2	3	0	2
94.0 - < 95.0	0	4	2	3	3	1	0	0
95.0 - < 96.0	3	3	5	4	3	3	2	5
96.0 - < 97.0	2	0	5	10	4	5	3	0
97.0 - < 98.0	1	1	1	3	9	5	1	0
98.0 - < 99.0	0	2	2	1	2	4	4	4
99.0 - < 100.0	2	1	3	1	9	6	2	5
100.0 - < 101.0	1	1	0	0	1	5	9	6
101.0 - < 102.0	4	0	0	4	4	4	5	4
102.0 - < 103.0	--	0	0	1	6	4	5	6
103.0 - < 104.0	--	0	4	1	5	5	5	5
104.0 - < 105.0	--	1	2	0	2	0	6	3
105.0 - < 106.0	--	--	1	0	1	3	4	6
106.0 - < 107.0	--	--	--	0	1	1	4	5
107.0 - < 108.0	--	--	--	0	0	0	3	0
108.0 - < 109.0	--	--	--	1	0	0	1	0
109.0 - < 110.0	--	--	--	--	1	1	1	3
110.0 - < 111.0	--	--	--	--	--	--	0	1
111.0 - < 112.0	--	--	--	--	--	--	0	--
112.0 - < 113.0	--	--	--	--	--	--	1	--
Total	39	49	39	49	59	59	59	59
Mean	92.7	91.8	96.0	95.0	98.6	98.1	1.9	101.2
Standard deviation	5.2	4.7	5.0	4.7	5.0	5.4	4.7	5.2

TABLE 13

FREQUENCY DISTRIBUTIONS FOR WEIGHT AT TIME OF THE FIRST AND SECOND PHYSICAL EXAMINATIONS OF THE CHILDREN OF THE DEMONSTRATION AND CONTROL GROUPS

Class intervals of weight	3-year-old series				4-year-old series			
	First Examination		Second Examination		First Examination		Second Examination	
	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group
Kilograms	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency
10.0 to <11.0	3	--	--	--	--	1	--	1
11.0 to <12.0	2	6	4	3	1	0	1	0
12.0 to <13.0	8	10	8	9	3	3	2	3
13.0 to <14.0	6	6	6	7	3	7	5	6
14.0 to <15.0	9	11	7	13	17	10	10	6
15.0 to <16.0	6	8	8	8	16	15	14	13
16.0 to <17.0	0	3	2	2	9	10	15	12
17.0 to <18.0	2	3	1	6	4	6	5	10
18.0 to <19.0	1	1	1	--	2	3	2	4
19.0 to <20.0	--	--	--	--	2	3	3	3
20.0 to <21.0	--	--	--	--	1	--	1	--
21.0 to <22.0	--	--	--	--	0	--	0	--
22.0 to <23.0	--	--	--	--	1	--	0	--
23.0 to <24.0	--	--	--	--	--	--	1	--
Total	37 1/	48 2/	37 1/	48 2/	59	58 2/	59	58 2/
Mean	13.9	14.1	14.1	14.4	15.6	15.6	15.9	15.9
Standard deviation	1.9	1.8	1.7	1.7	1.9	1.9	2.0	1.9

1/ Measurement not reported for 2 cases of this series.
2/ Measurement not reported for 1 case of this series.

TABLE 14

FREQUENCY DISTRIBUTIONS FOR TRANSVERSE BREADTH OF CHEST AND CRISTAL BREADTH, AT THE TIME OF THE FIRST PHYSICAL EXAMINATION OF THE CHILDREN OF THE DEMONSTRATION AND THE CONTROL GROUPS

Class intervals for transverse breadth of chest and cristal breadth	Transverse breadth of chest				Cristal breadth			
	3-year-old series		4-year old series		3-year-old series		4-year-old series	
	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group	Demonstration group	Control group
Centimeters	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency	Frequency
12.0 to <13.0	--	--	--	--	1	2	--	1
13.0 to <14.0	--	--	--	--	6	10	2	2
14.0 to <15.0	3	2	2	2	18	20	14	10
15.0 to <16.0	16	19	11	15	9	10	24	27
16.0 to <17.0	18	18	23	19	2	6	15	15
17.0 to <18.0	2	10	21	15	1	1	3	3
18.0 to <19.0	--	--	2	8	--	--	0	1
19.0 to <20.0	--	--	--	--	--	--	1	--
20.0 to <21.0	--	--	--	--	--	--	--	--
21.0 to <22.0	--	--	--	--	--	--	--	--
22.0 to <23.0	--	--	--	--	--	--	--	--
23.0 to <24.0	--	--	--	--	--	--	--	--
24.0 to <25.0	--	--	--	--	--	--	--	--
Total	39	49	59	59	37 1/	49	59	59
Mean	16.0	16.2	16.7	16.7	14.7	14.7	15.6	15.6
Standard deviation	0.7	0.8	0.9	1.1	1.0	1.1	1.1	1.0

1/ Measurement not recorded for 2 cases of this series.

TABLE 15

FREQUENCY DISTRIBUTIONS FOR AGE IN MONTHS OF THE CHILDREN OF THE DEMONSTRATION AND CONTROL GROUPS AT THE TIME OF THE FIRST PHYSICAL EXAMINATION

Class intervals of age	3-year-old series		Class intervals of age	4-year-old series	
	Demonstration group	Control group		Demonstration group	Control group
Months	Frequency	Frequency	Months	Frequency	Frequency
30 to < 31	1	4			
31 to < 32	3	3	42 to < 43	5	5
32 to < 33	4	4	43 to < 44	7	5
33 to < 34	3	5	44 to < 45	1	2
34 to < 35	4	4	45 to < 46	8	3
35 to < 36	5	6	46 to < 47	4	3
36 to < 37	3	9	47 to < 48	5	7
37 to < 38	5	3	48 to < 49	6	9
38 to < 39	2	2	49 to < 50	7	5
39 to < 40	0	2	50 to < 51	4	7
40 to < 41	4	2	51 to < 52	1	4
41 to < 42	5	5	52 to < 53	6	5
			53 to < 54	5	4
Total	39	49	Total	59	59
Mean	35.8	35.2	Mean	47.3	48.2
Standard deviation	3.3	3.3	Standard deviation	3.5	3.3

TABLE 16

CORRELATION OF THE SERVINGS PER WEEK PER CHILD CALCULATED FROM THE MEASURED DIET RECORDS AND FROM THE CONVERTED QUANTITATIVE DIET RECORDS FOR SPECIFIED CLASSES OF FOODS

Food class and group	Cases		Correlation by rank (R)	Coefficient of correlation	Criterion of significance
	Measured diet records	Converted diet records			
	Number (N)	Number (N)		r	t 1/
Fruits and vegetables					
Demonstration and control cases combined	17	17	.69	.71	3.90
Meat, fish and poultry					
Demonstration cases	11	11	.75	.77	3.62
Control cases	6	6	.77	.78	2.49
Potatoes					
Demonstration and control cases combined	17	17	.46	.48	2.12
Bread and cereals					
Demonstration and control cases combined	17	17	.82	.83	5.76
Desserts and sweets					
Demonstration and control cases combined	17	17	.33	.34	1.40

1/ $t = \frac{r\sqrt{n}}{\sqrt{1-r^2}}$ $\quad n = N - 2$

A STUDY OF THE RELATIONSHIP BETWEEN PSYCHOMETRIC PATTERNS AND PERSONALITY TYPES[1]

MARJORIE GERLACH[2]

THE PROBLEM

This study is concerned with the problem of the relationship of the psychometric pattern to the type of maladjustment in a group of school children referred to an adjustment clinic.

The difference between results found in performance and verbal intelligence tests forms the basis of the psychometric pattern. The nature of the child's reaction to his social environment as it is observed in his school activities, his leisure time activities and in the home, supplies the material for his classification into one of two broad maladjustment types, namely: asocial and aggressive.

The examination of a group of complete case histories including the psychological records, is the source of the data from which the study of the problem of the relationship between type of maladjustment behavior and psychometric pattern is made. As an auxiliary problem this relationship is considered within three subgroups, divided according to parental nativity. In addition, certain aspects which may throw added light on the problem receive attention. Among these are the relation of age, performance and verbal intelligence to asocial and aggressive behavior.

INTRODUCTION

The use of the intelligence test not only as a means of finding the intelligence quotient of the individual examined but also as a key to the understanding of his personality in a wider sense is one which has come into consideration only within recent years. It has always been known that the difference between verbal and performance ratings is frequently high, and this discrepancy has been of increasing interest. This interest is based on the assumption that where a certain relationship of performance-verbal test results is persistently found in conjunction with a certain type of personality trend the relation of the two is significant.

Typical of the interest in this relationship is a study made by Uhler, Jastak, Glanville and Oberlin (1) in 1937. They found in examining 100 state hospital patients, psychotic and non-psychotic, that 86 psychotic patients exhibited a psychometric pattern in which the verbal quotient was high and the performance quotient low. In contrast, 14 non-psychotics showed no significant difference between verbal and performance scores. In the same year Uhler made a study of children of school age (six to eighteen) and found that those having "higher psychomotor ability were referred mostly as delinquent problems; least of all as problems of personality defect" and that "children with higher verbal ability were referred mostly as personality defects, with delinquency coming lowest ..." (2)

It would appear that this field is a fertile one for further investigation.

The present study was conducted in a clinic, staffed with psychiatrists, psychologists, a physician and social workers, in a near-slum section of New

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York City. Children are referred to this clinic from schools in the neighborhood. Referrals are made by the teachers of the children through the principals of the schools or the Bureau of Attendance.

As the clinic has been established in this location for more than three years the schools are not only well acquainted with its facilities but in a sense educated to take advantage of its aid in readjusting their "problem children." The presence of the clinic has perhaps made the teachers more aware of the fact that the recessive, day-dreaming child in the classroom is as much a problem, if not more so, as is his aggressive, misbehaving schoolmate. The types of referrals made to the clinic are most varied and many suggest an acuteness of perception of maladjustment which could hardly have been the case a decade ago.

More than 200 case histories were examined in the process of selecting complete case histories complying with the qualifications of this study. A complete case history included the records of the physical, psychological and psychiatric examinations; a complete social history by the social worker; a complete copy of the school record; the original referral and any following reports from the teacher; records of any previous examinations, interviews and referrals; any correspondence concerning the case from various welfare agencies; and progress notes.

Of the cases examined 61 met the following requirements in every respect:

1. Sex: male.
2. Color: white.
3. Age: from the ninth birthday through the twelfth year.
4. Intelligence: above 70 I.Q.
5. Health: found physically and neurologically sound by medical examination.
6. Degree of maladjustment: behavior and personality problems which were not sufficiently acute as to have resulted in a record of actual delinquency or to have been classifiable by the psychiatrist as psychotic in trend.
7. Psychological examinations: records of the Cornell-Coxe and the Stanford-Binet in the battery of tests administered by a competent psychologist.

In classifying the children according to the type of maladjustment, the definitions of Fenton and Wallace (3) were taken as illustrative of the discriminating standards. They describe a behavior problem as "...not anti-social in the broader sense but....a source of annoyance and concern because of unacceptable aggressive behavior. Petty stealing in the home, temper tantrums, stubborness, destructiveness, unruliness, hyperactivity, etc." A personality problem is defined by them as: "asocial behavior of a non-aggressive type, as shyness, bashfulness, fears or anxiety; enuresis, speech defects, hypochondria..."

In order to keep in mind the fact that the basis of distinction between the two maladjustment types as they are used in this study is the nature of the child's reactions to society, i.e., attack upon it or withdrawal from it, we shall use the terms aggressive and asocial as descriptive of the behavior and personality problems described above. Only these two broad types, aggressive and asocial, are used throughout this study. True delinquency, which Fenton and Wallace describe as "....adjudged guilty of some anti-social offense - as assault, forgery, stealing, drunkeness, sexual promiscuity..." is not included as a basis of classification in this study. Nor was retardation "not due to severe mental disability" taken as a separate category. Where retardation was found to be present it was regarded as one more manifestation of the general trend toward either aggressive or asocial maladjustment. Thus it is apparent

that the present study is concerned with the examination of the middle ground, as it were, of manifestation of maladjustment, and that only children falling into the types of aggressive or asocial activity were accepted for study.

Ratings on the Cornell-Coxe and the Stanford-Binet were used as measures of performance and verbal intelligence respectively. The Stanford-Binet was first "corrected" by the removal of all performance tests, in each case, and rescored on the basis of the verbal tests only.

From a consideration of the results of these tests each case was then classified according to general intelligence. The three groups of general intelligence were defined as: Average (I.Q.'s 90-110), Below Average (I.Q.'s 70-90) and Above Average (above I.Q. 110).

A further classification was made on the basis of the difference between the performance and the verbal test results. A difference of eight or more points between the results of the performance and verbal tests was arbitrarily set in designating a category. Where this difference exists the case is classified according to the comparative relationship of the two tests, e.g., if the performance rating is I.Q. 105 and the verbal rating is I.Q. 95 the classification is High Performance-Low Verbal. In addition, such a case would be classified as Average, so that its complete classification, as far as ratings are concerned, would be Average High Performance-Low Verbal. Where there is less than eight points difference between performance and verbal ratings the case is classified as being "on par."

Thus, taking the three groups according to general intelligence, and the three variations according to the relationship between performance and verbal ratings, we have nine separate categories for the classification of the cases according to their ratings on the Cornell-Coxe and the Stanford-Binet. These nine categories are:

1. Average on par.
2. Average High Performance-Low Verbal.
3. Average Low Performance-High Verbal.
4. Below Average on Par.
5. Below Average High Performance-Low Verbal.
6. Below Average Low Performance-High Verbal.
7. Above Average on Par.
8. Above Average High Performance-Low Verbal.
9. Above Average Low Performance-High Verbal.

In addition to classification according to maladjustment type and psychometric pattern, each case was once more classified according to the nativity of the parents: both parents foreign born (FF); one parent Foreign, one American born (FA); and both parents American born (AA).

Thus we have three different bases of classification for each case: 1) according to maladjustment type (aggressive or asocial); 2) according to intelligence (in general and in regard to the difference between the Cornell-Coxe and the Stanford-Binet ratings); and 3) according to parental nativity (FF, FA, AA). The various relations between these three main bases of classification will be shown as the study proceeds.

Table 1 shows the classification of the original data according to maladjustment type, parental nativity, chronological age and ratings on the Cornell-Coxe and the Stanford-Binet. The letter "A" is given to those falling into the asocial type; the letter "B" to those falling into the aggressive type of maladjustment. The classification according to parental nativity is made by dividing the group as a whole into three subgroups: FF (both parents foreign born), FA (one parent foreign, one American born) and AA (both parents American born).

TABLE 1

ORIGINAL DATA SHOWING CLASSIFICATION ACCORDING TO MALADJUSTMENT, PARENTAGE, CHRONOLOGICAL AGE AND TEST RATINGS

	Case	Mal. Type	Chron. Age	C-C I.Q.	S-B I.Q.
FF (36 cases)	1	B	12-11	104	90
	2	A	10- 9	88	97
	3	B	10- 7	91	92
	4	B	9- 0	107	94
	5	B	12- 8	114	86
	6	A	9-10	96	90
	7	A	12- 3	110	78
	8	A	11-10	73	90
	9	B	12- 7	93	90
	10	B	9- 1	94	80
	11	A	12- 4	84	78
	12	B	10- 9	100	92
	13	B	12- 2	111	82
	14	A	10- 8	85	87
	15	A	11- 9	91	82
	16	A	10- 8	101	84
	17	A	10- 5	84	74
	18	A	10- 6	98	92
	19	A	9-10	87	81
	20	A	11- 9	140	123
	21	A	10- 8	106	106
	22	B	12- 8	78	85
	23	A	10- 2	80	84
	24	A	10- 8	92	83
	25	B	11- 6	141	87
	26	A	12- 2	127	95
	27	A	12- 7	86	101
	28	A	10- 3	146	99
	29	B	10- 4	94	83
	30	A	10- 8	85	84
	31	A	10-10	97	81
	32	B	11- 8	99	83
	33	A	10- 0	96	91
	34	B	12- 6	120	93
	35	B	11-11	115	81
	36	A	11- 3	91	79
FA (15 cases)	37	A	9-11	71	77
	38	A	9- 7	83	73
	39	A	10-11	80	89
	40	A	9- 0	89	82
	41	B	11- 9	95	93
	42	A	9-11	128	92
	43	A	12- 4	92	78
	44	A	11- 8	92	88
	45	B	10-10	125	94
	46	A	10- 0	83	73
	47	B	11- 9	91	85
	48	A	9- 7	106	98
	49	B	11- 3	93	79
	50	B	10- 0	107	104
	51	A	11- 6	91	86
AA (10 cases)	52	B	9- 7	103	104
	53	B	12-11	128	89
	54	A	10- 1	115	100
	55	A	11-11	76	79
	56	B	11-11	103	94
	57	A	10-11	90	83
	58	B	9- 9	100	102
	59	B	11-11	130	115
	60	A	12-11	122	79
	61	A	9- 9	91	91

TABLE 2

		Below Average on par (70-90)	Below Average High Perf. Low Verb.	Below Average Low Perf. High Verb.	Average on par (90-110)	Average High Perf. Low Verb.	Average Low Perf. High Verb.	Above Average on par (110)	Above Average High Perf. Low Verb.	Above Average Low Perf. High Verb.	
Asocial	FF	14*,23, 2,11, 19,30 (6)	17,24 31,15, 36 (5)	8 (1)	18,21 6,33 (4)	7,16 (2)	27 (1)		20,26 28 (3)		22
	FA	37,40 51 (3)	43,38, 46 (3)	39 (1)	44 (1)	48 (1)			42 (1)		10
	AA	55,57 (2)			61 (1)	54,60 (2)					5
		(11)	(8)	(2)	(6)	(5)	(1)		(4)		37
Aggressive	FF	22 (1)	10,29 (2)		3,9 (2)	1,4,5,12, 13,32,34, 35 (8)			25 (1)		14
	FA		47,49 (2)		41,50 (2)	45 (1)					5
	AA				52,58 (2)	56,53 (2)			55 (1)		5
		(1)	(4)		(6)	(11)			(2)		24
		12	12	2	12	16	1		6		(61)

*These numbers are the case numbers as shown in Table 1.

The range on the Stanford-Binet is from 73 to 123; on the Cornell-Coxe, from 71 to 146. From the first column in Table 1 it is seen that in 36 cases both parents are foreign born; in 15 cases one parent is foreign born, one American born; and in 10 cases both parents are American born. The proportion of 36, 15 and 10 is probably representative of the cases which are referred to this clinic on the whole.

The fact that we are dealing with a group of children some of whom are from homes in which a foreign language is spoken in addition to English does not complicate the problem of the relation between the maladjustment type and the test ratings if we accept the findings of Pintner and Arsenian (5) in regard to bilinguality. They say, "Bilingualism...bears no relation to verbal intelligence and school adjustment...."

Although the problem of the relationships occurring in connection with the three subgroups according to parental nativity is a subsidiary one, to facilitate later observations we shall maintain these three subgroups in Table 2.

Table 2 shows the distribution of all the cases when divided according to the three different bases of classification which were described previously: maladjustment (aggressive (B) and asocial (A)); psychometric (according to the nine categories of test results); and parental nativity (FF, FA and AA).

From Table 2 we may examine first the distribution of the cases when classified according to the two types of maladjustment: asocial (A) and aggressive (B). Of the entire group of 61 cases, 37 fall into the A or asocial type and 24 into the B or aggressive type. This is somewhat of a surprise; we are accustomed to think of the aggressive type as more likely to be referred to a clinic for treatment than the asocial type. But perhaps David Levy's observation that "Children are more likely to be referred for acts of aggression - quarreling, disobedience, temper tantrums, rebellious habits - than for excessive obedience and submission," (6) does not necessarily hold under the present circumstances. It must be remembered that the "educative" force of the clinic in regard to the teachers who avail themselves of its aid is a powerful one. And then, too, one may believe that the teacher is often more likely to cope with classroom misbehavior by immediate disciplinary action than she is able to find a solution to the problem of the asocial child - who, in a sense, evades inter-personal contacts. It may be, too, that in the present study the age limits (set at 9 through 12), are a factor in determining the proportion of asocial and aggressive referrals.

Our second point of interest in regard to Table 2 is in the distribution of the cases according to their performance or verbal ratings. It is apparent that the heaviest concentration of cases is in the Average and Below Average divisions in general, and in the divisions indicating a significant superiority of performance ratings to verbal in particular. The meagerness of cases in the Above Average divisions as a whole is rather striking.

Since the number of cases in the maladjustment groups differ (asocial 37; aggressive 24) the raw numbers according to test ratings have been converted into percentages of the two maladjustment groups in order to give a clearer picture of the relationship between them.

From Table 2a we see that the largest percentage of cases in the Asocial group is 30 per cent at the Below Average on Par level; at this same level there is only 4 per cent of the aggressive cases. This means that the percentage of asocial cases having a psychometric pattern of Below Average on Par (that is, whose ratings on both verbal and performance tests are similar and below average) is more than 7 times as great as that of the aggressive cases. Further, the highest percentage of cases in the aggressive group is 46 per cent at the Average High Performance-Low Verbal level. This represents a concentration of

TABLE 2a

PERCENTAL RELATIONS OF MALADJUSTMENT GROUPS AND PSYCHOMETRIC DIVISIONS

	Asocial	Total	Aggressive	Total
Below Av. on par	30%		4%	
Bel. Av. High Perf-Low Verbal	22%		17%	
Bel. Av. Low Perf-High Verbal	5%		0	
		57%		21%
Average on par	16%		25%	
Av. High Perf-Low Verb.	13%		46%	
Av. Low Perf-High Verb.	3%		0	
		32%		71%
Above Av. on par	0		0	
Above Av. High Perf-Low Verb.	11%		8%	
Above Av. Low Perf-High Verb.	0		0	
		11%		8%

almost half of all the aggressive cases and is in sharp contrast to the 13 per cent of asocial cases at this level.

More than two and a half times as great a percentage of asocial cases fall in the Below Average levels altogether as that of the aggressive group. The percentage of cases in both maladjustment groups at the Above Average levels is conspicuous by its lowness.

This seems to point toward a considerably higher incidence of the asocial type of maladjustment among children whose performance and verbal test results are of a below average quality in general. These children seem also to show a significant difference between performance and verbal ratings less frequently than do those of the aggressive type. Children of the aggressive type of maladjustment seem more likely to have average test ratings on the whole and, at the average level, to show a significant superiority of performance test rating to verbal rating. Further indication of this appears in Table 3.

By the rank-difference method a ρ of .322 was found for the Cornell-Coxe and Stanford-Binet ratings of the aggressive group and a ρ .514 for the asocial group. ρ .322 is equivalent to an r of .33, with a P.E. of .10; and ρ .514 is equivalent to an r of .53 with a P.E. of .08. Since the Cornell and Coxe correlation of the Cornell-Coxe and Stanford-Binet ratings is .79, it is apparent that the correlation within the aggressive and asocial groups is comparatively low. However, the markedly lower correlation of the aggressive group, as compared with the asocial, seems to indicate a greater disparity between Cornell-Coxe and Stanford-Binet ratings in the aggressive group than in the asocial.

Although little has been said thus far about the subgroups according to parental nativity other than to indicate their distribution in Table 2, because the numbers were too small to be of consequence, the averages of their performance and verbal ratings also are given in Table 4 simply as supplementary points

TABLE 3

COEFFICIENTS OF CORRELATION FOR CORNELL-COXE AND STANFORD-BINET

No. Cases		
24	Aggressive group	(ρ .322) r = .33 ± .10
37	Asocial group	(ρ .514) r = .53 ± .08
61	Entire group	(ρ .50) r = .52 ± .07
476	Cornell & Coxe group	r = .79

TABLE 4

AVERAGES OF PERFORMANCE AND VERBAL RATINGS

		ASOCIAL			AGGRESSIVE			BOTH GROUPS		
	No. Cases	I.Q.'s CC	SB	(diff.)	I.Q.'s CC	SB	(diff.)	I.Q.'s CC	SB	(diff.)
Entire Group	(61)	96	87	(9)	106	93	(13)	101	90	(11)
FF	(36)	97	89	(9)	104	87	(17)	101	88	(13)
FA	(15)	91	84	(7)	102	91	(11)	97	87	(10)
AA	(10)	99	86	(13)	113	101	(12)	106	94	(12)

of interest, in addition to a comparison of the averages of the test ratings in the maladjustment groups.

From the first section of Table 4 it is apparent that, not only in the entire group but also in the parental subgroups, the CC and SB averages in the Asocial are inferior to those of the Aggressive on the whole. Also it is apparent that in the entire group and in each of the parental subgroups except the AA, the difference between the averages on the two tests used are greater in the Aggressive than in the Asocial. That of the FF subgroup is strikingly large. It is probable that the small number of cases (ten) in the AA subgroup has an effect on this factor here.

This tends to bear out the findings which have been discussed previously, namely: that on the whole the performance and verbal ratings of the Asocial group are inferior to those of the Aggressive group, and that in the aggressive group on the whole the difference between the average Cornell-Coxe and Stanford-Binet ratings is greater than in the Asocial group.

The averages for the aggressive and asocial groups combined is interesting chiefly because it indicates the differences on the whole between the three parental subgroups. It is apparent that the AA subgroup is the highest and the FA subgroup the lowest on both Cornell-Coxe and Stanford-Binet ratings.

In investigating the part which chronological age may play in the relationship between the maladjustment types and the performance and verbal ratings certain interesting aspects are seen from Table 5.

It is apparent that in the asocial group the heaviest concentration of cases is at the ten year level, whereas in the aggressive group, although in general the distribution is more even, there seems to be a tendency to cluster around the eleventh and twelfth years. We see also that in the aggressive group a fairly clear-cut progression is shown as we move from the ninth year through the twelfth. That is, the Cornell-Coxe averages tend to grow slightly higher with increase in age while, in the same direction, the Stanford-Binet averages become

TABLE 5

RELATION OF CHRONOLOGICAL AGE AND MALADJUSTMENT TYPES TO PERFORMANCE AND VERBAL RATINGS

ASOCIAL					AGGRESSIVE					ENTIRE GROUP				
Age	No. Cases	CC	SB	(diff.)	Age	No. Cases	CC	SB	(diff.)	Age	No. Cases	CC	SB	(diff.)
9*	8	94	85	(9)	9	4	101	95	(6)	9	12	96	89	(7)
10	16	95	87	(8)	10	5	104	93	(11)	10	21	97	89	(8)
11	7	93	90	(3)	11	8	108	90	(8)	11	15	101	90	(11)
12	6	104	85	(19)	12	7	107	88	(19)	12	13	105	86	(19)

*Year level includes that year up to beginning of next year.

slightly lower. This means also, of course, that as age increases in the aggressive group the difference between the Cornell-Coxe and Stanford-Binet averages also increases.

This trend in regard to difference between the Cornell-Coxe and Stanford-Binet ratings has a puzzling variation in the asocial group. There, from the ninth through the eleventh years the difference in ratings between the two tests tends to grow smaller. But at the twelfth year it suddenly deviates from this progression to the extent of equalling the difference at this year level in the aggressive group. One is led to speculate on the possibility of asocial children at the twelfth year level beginning to turn toward an aggressive type of expression. Such speculations are assisted by the observation that, as has been remarked before, the majority of asocial cases cluster at the ten year level whereas that of the aggressive cases tends to be higher.

Another aspect of the relation of age to maladjustment types is given in Table 6. Here the variation according to the subgroups of parental nativity is shown. Although size of the subgroups prohibits attempting to draw conclusions regarding them, nevertheless an interesting, if dim, sidelight is thrown on the problem by an examination of their figures.

In Table 6 we see that approximately two-thirds as many of the FF cases fall in the aggressive group as in the asocial. In the FA group there are half as many in the aggressive as in the asocial, and in the AA group they are evenly divided.

This indicates that for the group studied proportionately more children of FA than of AA parents have the asocial type of maladjustment.

In general the distribution according to age within the subgroups is comparable to that shown in Table 5. However, one fact in regard to the distribution of FA cases in both groups where age is concerned is not apparent from Table 6. Therefore Table 7, showing the average ages in years and months, for the different sections within the B and A classifications, is given.

From Table 7 it is apparent that despite our previous observations regarding the clustering of B and A cases at certain year levels, on the whole, the differ-

TABLE 6

DISTRIBUTION OF MALADJUSTMENT GROUPS
ACCORDING TO AGE AND PARENTAGE

Year	FF		FA		AA	
	B	A	B	A	B	A
			No. Cases			
9	2	2		5	2	1
10	3	12	2	2		2
11	3	4	3	2	2	1
12	6	4		1	1	1
	14	22	5	10	5	5

TABLE 7

AVERAGE AGE OF GROUPS

	B	A
FF	11 years, 5 mos.	11 years, 5 mos.
FA	11 years, 1 mo.	10 years, 5 mos.
AA	11 years, 3 mos.	11 years, 2 mos.
Entire Group	11 years, 3 mos.	11 years, 0 mos.

ence is a small one - specifically, a three month average superiority in age of aggressive cases over asocial for the entire group. But in the FA subgroup we see that the average age for aggressive children is eight months greater than that of the asocial children. This seems to point toward an earlier incidence of asociality in children of FA parentage than is the case in the other two parental subgroups.

CONCLUSIONS AND CONJECTURES

Within the qualifications set in this study we may conclude that:

1. Children of the asocial type tend on the whole to be inferior in intelligence ratings to those of the aggressive type.
2. Although in both asocial and aggressive types there is general superiority of performance ratings over verbal, in the aggressive group this superiority is noticeably greater and increases with age.
3. There is a slight age superiority of aggressive cases over asocial. In the foreign-American parentage subgroup the age superiority of the aggressive cases is more noticeable by contrast with the earlier incidence of asociality in this group.

It is possible that the markedly earlier incidence of asociality in the foreign-American parentage group is a point worth noting. It may be that conflict of cultures in the home has its effect on the personality of the child particularly if, as is probable, there is also conflict in ideas concerning discipline. One might suppose that added conflict serves to accelerate the onset of maladjustment.

It is apparent that there is some connection between inferior rating on the performance and verbal tests and asociality. Whether asociality finds particularly fertile soil in children of this mental calibre or whether children who, in a sense, withdraw from society are more prone to inadequacy in dealing with performance and verbal material might be more clearly shown if this study were extended to larger groups.

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THE SIGNIFICANCE OF AN IMPROVED CALENDAR IN CHILD DEVELOPMENT RESEARCH

HARRIET ELIZABETH NEALL[1]

The calendar is a basic tool in the field of child development. Calendar dates are used to compute the chronological age of a subject at the time of a given test or observation. Calendar dates are also used to compute the interval which has elapsed between two tests, a point of special importance in cumulative studies of development. Thus an essential item in almost every record is the date upon which the test or observation was made. The investigator may wish to control the time element by testing the child when he is of a specified chronological age, or by retesting him at regular intervals of, for example, one month, six months, or one year. In this case, the arrangement of individual appointments for a group of subjects is a practical administrative task in which the calendar must be consulted constantly.

The confusing irregularities of the present Gregorian calendar are thus of significance to workers in the field of child development. An improved calendar is now proposed. This World Calendar, with a summary of its chief characteristics, is printed on the next page. The World Calendar is in the hands of a special committee of the League of Nations, but war conditions have postponed the negotiations necessary to its adoption. Meanwhile workers in the field of child development should give careful consideration to this proposed calendar from the point of view of their own interests and needs. It appears to offer the following advantages:

1. The initial recording of a correct date would be easier with a systematic, perpetual calendar.

2. The planning and making of appointments should be greatly simplified. Notice that a birthdate will always recur on the same day of the week year after year.

3. Intervals between tests could be more easily equated because the year is divided into equal quarters and all months have either thirty or thirty-one days.

4. The computation of intervals between dates should be simplified, especially if the exact number of days in the interval is required. The Year-Day can easily be allowed for, but our present irregular months cause complication. The irregularity produced by Leap-Year is to be found in our present calendar and cannot be eliminated.

The change to an improved calendar need not disturb cumulative studies now in progress. Since the total number of days in the year is unchanged, an "equivalent date" in the new calendar can easily be computed for each date in the Gregorian Calendar. For example, the sixty-first day of the year is March 2 in the Gregorian Calendar and February 30 in the World Calendar. With all dates converted into the new form, computations of time intervals could proceed without the introduction of error.

[1] *From Berkeley, California.*

THE WORLD CALENDAR

All Years Alike
All Quarters Equal

First Quarter							Second Quarter							Third Quarter							Fourth Quarter						
JANUARY							APRIL							JULY							OCTOBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14	8	9	10	11	12	13	14
15	16	17	18	19	20	21	15	16	17	18	19	20	21	15	16	17	18	19	20	21	15	16	17	18	19	20	21
22	23	24	25	26	27	28	22	23	24	25	26	27	28	22	23	24	25	26	27	28	22	23	24	25	26	27	28
29	30	31	..	..	..	..	29	30	31	..	..	..	.	29	30	31	..	..	..	..	29	30	31	..	..	..	..
FEBRUARY							MAY							AUGUST							NOVEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
..	..	..	1	2	3	4	..	..	..	1	2	3	4	..	..	..	1	2	3	4	..	..	..	1	2	3	4
5	6	7	8	9	10	11	5	6	7	8	9	10	11	5	6	7	8	9	10	11	5	6	7	8	9	10	11
12	13	14	15	16	17	18	12	13	14	15	16	17	18	12	13	14	15	16	17	18	12	13	14	15	16	17	18
19	20	21	22	23	24	25	19	20	21	22	23	24	25	19	20	21	22	23	24	25	19	20	21	22	23	24	25
26	27	28	29	30	..	.	26	27	28	29	30	..	..	26	27	28	29	30	..	.	26	27	28	29	30	..	..
MARCH							JUNE							SEPTEMBER							DECEMBER						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
..	..	..	..	..	1	2	..	..	..	..	..	1	2	..	..	..	..	..	1	2	..	..	..	..	..	1	2
3	4	5	6	7	8	9	3	4	5	6	7	8	9	3	4	5	6	7	8	9	3	4	5	6	7	8	9
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17	18	19	20	21	22	23	17	18	19	20	21	22	23	17	18	19	20	21	22	23	17	18	19	20	21	22	23
24	25	26	27	28	29	30	24	25	26	27	28	29	30	24	25	26	27	28	29	30	24	25	26	27	28	29	30
													**														*

* YEAR-END DAY, December Y or 31, an extra Saturday, follows December 30th every year.
** LEAP-YEAR DAY, June L or 31, another extra Saturday, follows June 30th in leap years.

The World Calendar is a revision of the present calendar to correct its inequalities and discrepancies. It rearranges the length of the 12 months so that they are regular, making the year divisible into equal halves and quarters in a *"perpetual"* calendar. Every year is the same; every quarter identical.

In this new calendar, each quarter contains exactly three months, 13 weeks, 91 days. Each quarter begins on Sunday and ends on Saturday. The first month in each quarter has 31 days, and the other two 30 days each. Each month has 26 weekdays.

In order to make the calendar perpetual, at the same time retaining astronomical accuracy, the 365th day of the year, called Year-End Day, is an intercalary day placed between December 30th and January 1st and considered an extra Saturday. The 366th day in leap year, called Leap-Year Day, is intercalated between June 30th and July 1st on another extra Saturday. These intercalary or stabilizing days are tabulated as December Y or 31 and June L or 31, and would probably be observed as international holidays. January 1st, New Year's Day, always falls on Sunday.

The revised calendar is balanced in structure, perpetual in form, harmonious in arrangement. It conforms to the solar year of 365.2422 days and to the natural seasons. Besides its advantages in economy and efficiency, it facilitates statistical comparisons, coordinates the different time-periods, and stabilizes religious and secular holidays when approved by their respective authorities. As compared with any other proposal for calendar revision, it offers an adjustment in which the transition from the old to the new order can be made with a minimum of disturbance.

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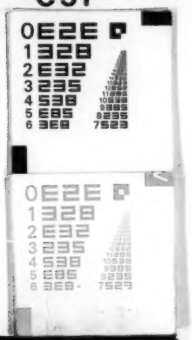
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